

***The status and possible future of international
collaboration in Antarctic research between Korea
and New Zealand***

A thesis submitted in fulfilment of the requirements for the Degree of
Master of Antarctic Studies

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Abstract

The Antarctic Treaty celebrates and safeguards the idea of international collaboration, which includes the encouragement to share infrastructure and information between Parties to the Antarctic Treaty and, consequently, also between National Antarctic Programmes. Antarctic research is considered the currency of the Antarctic Treaty System. Especially in the early years after the Antarctic Treaty entered into force, some Parties saw Antarctic research as a way to obtain more power and influence in Antarctic affairs. Attitudes have now changed, and international collaboration is high on the agenda for Antarctic Treaty Parties. This development has been stimulated significantly by the Scientific Committee on Antarctic Research (SCAR), which conducted a comprehensive Antarctic and Southern Ocean Horizon Scan to agree on 80 important research questions that need to be addressed over next two decades. The Council of Managers of National Antarctic Programs (COMNAP) followed SCAR's Horizon Scan with the Antarctic Roadmap Challenge (ARC) project, which aims at identifying the most appropriate and feasible methods to address the Horizon Scan questions as well as assessing national capabilities and the required logistics in support of research pursuing these questions. The SCAR Horizon Scan and COMNAP's ARC project provide the basis for an Antarctic research agenda and both emphasise that international collaboration is absolutely essential to address the complex questions posited by the Horizon Scan. Some Antarctic Treaty Parties have a long history of collaboration, both logistically and scientifically, such as New Zealand and the USA. New Zealand has a relatively partnership with the Republic of Korea, which goes back to the time of the Korean War. However, in the Antarctic realm, this partnership remains to be small-scale and based on connections between individual researchers.

This dissertation explores the framework within which New Zealand's and the Republic of Korea's Antarctic collaboration unfolds in order to seek to understand why their Antarctic collaboration is not more advanced. To achieve this, the Korean Antarctic research landscape is being analysed, and Korean perspectives, motivations and thinking with regard to the Korean Antarctic Programme are discussed. In Korea, multiple institutions have shown their interest in Antarctic research by making investments in Antarctic infrastructure and research capacity. Whilst the willingness to collaborate with international players, including New Zealand, is expressed by different players in the Korean Antarctic Programme, and while

similar sentiments are being voiced by New Zealand's Antarctic Research Programme, a lack of understanding of the values and *modi operandi* of the other programme hinder more effective collaboration.

This dissertation contributes a detailed glance into what drives the Korean Antarctic Programme, and also offers a glimpse of how the Chinese Antarctic Programme operates, to facilitate an improved awareness of the different perspectives and approaches taken by these influential Asian players within New Zealand and, thereby, to assist in strengthening the collaboration between the Korean and New Zealand Antarctic Programmes.

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List of Abbreviations

ACC	Antarctic Circumpolar Current
ARC	Antarctic Roadmap Challenge
ATCM	Antarctic Treaty Consultative Meeting
ATS	Antarctic Treaty System
BDI	Busan Development Institute
BMC	Busan Metro City
CAA	Chinese Arctic and Antarctic Administration
CACPR	Chinese Advisory Committee for Polar Research
CAP	Chinese Antarctic Program
CCAMLR	Convention for the Conservation of Marine Living Resources
CEE	Comprehensive Environmental Evaluation
CHINARE	Chinese Antarctic Research Expedition
COMNAP	Council of Managers of National Antarctic Programs
DPR	Democratic People's Republic of Korea
FTA	Free Trade Agreement
IAATO	International Association of Antarctica Tour Operators
IBRV	Ice-Breaking Research Vessel
ICI	Incremental Citation Impact
ICT	Information and Communication Technology
IGY	International Geophysical Year
ISI	Institute for Scientific Information
IUU	Illegal, unregulated, and unreported
KAARP	Korea Arctic and Antarctic Research Program
KAP	Korea Antarctic Program
KARP	Korea Antarctic Research Program
KCNA	Korea Central News Agency
KHOA	Korea Hydrographic and Oceanographic Agency
KIOST	Korea Institute of Ocean Science and Technology
KIST	Korea Institute of Science and Technology
KMI	Korea Maritime Institute
KOPRI	Korea Polar Research Institute
KORDI	Korea Ocean Research and Development Institute

KORDI	Korea Ocean Research and Development Institute
KOSAP	Korea Supporters Association for Polar
KRISO	Korea Research Institute of Ship and Ocean
LOI	Letter of intent
LoU	Letter of Understanding
MFAT	Ministry of Foreign Affairs and Trade
MOF	Ministry of Ocean and Fisheries
MOFA	Ministry of Foreign Affairs
MOU	Memorandum of Understanding
MPA	Marine Protected Area
NAP	National Antarctic Programs
NFRDI	National Fisheries Research & Development Agency
NIFS	National Institute of Fisheries Science
NIWA	National Institute of Water and Atmospheric Research Ltd.
ODA	Official Development Assistance
PAP	Polar Academic Program
PoF	Polar Maritime Future Forum
PRC	People's Republic of China
PRIC	Polar Research Institute of China
R&D	Research and development
RV	Research Vessel
SAE	Soviet Antarctic Expedition
SAFAIR	South Africa Airline
SCAR	Scientific Committee on Antarctic Research
SCI	Science Citation Index
SEK	Sea Explorer of Korea
SOA	State Oceanic Administration
TAE	Trans-Antarctic Expedition
TAO	The Antarctic Office
US	United States

1. Introduction

Since the heroic era of Antarctic expeditions, New Zealand has been a focal point for Antarctica. Historically, the feasible accessibility to the South Pole has persuaded many pioneers, including scientists and researchers, to use New Zealand as gateway. The foundation of New Zealand Antarctic research was initiated with “the willing assistance of the United States of America (USA) for the establishment of Scott Base in order to provide support for the trans-Antarctic expedition (TAE) and the International Geophysical Year(IGY)” (Harrowfield, 2007). Also the USA and New Zealand jointly established Hallett Station, located at the southern end of Moubray Bay, northern Victoria Land in 1957, and operated it jointly as a year-round research station (Gordon, 2003). In short, New Zealand’s Antarctic research has been profoundly interrelated with international collaboration since the presence of New Zealanders on the Ross Dependency. The success of the expedition and science research of both the TAE and IGY illustrated the extent to which international cooperation in science could be possible (Harrowfield, 2007). To put aside disputes over sovereignty issue of Antarctica, those participating states agreed to use Antarctica only for peaceful purposes and to promote international cooperation under freedom of scientific investigation, which was documented in 1959 and called the Antarctic Treaty. Additionally, the Antarctic Treaty was built to support the freedom of science in and around Antarctica and to promote international cooperation by sharing information, knowledge, and any scientific data.

Unlike the initial aims, the Antarctic governance or Antarctic affairs has historically been competitive rather than cooperative. Klaud Dodds (2010) described the science in Antarctica as a form of currency in Antarctic governance, where the scientific knowledge has been utilised as political credibility for states in influencing Antarctic affairs. The governments of states engaged in supporting research in Antarctica, as long as the results from it enhanced their influence over Antarctic affairs.

Yet the perspective has changed to refocus on Antarctica as a continent *for* science not *by* science in order to enhance each country’s political credibility [italics in original] (Elzinga, 1992). It is interesting that the perspective on Antarctica has been altered from *res nullius* to *res communis* under the common heritage of mankind. The original concept of *res nullius* is synonymously explained as “unclaimed territory or property”, allowing other states to possess

and to exploit a common area (Shackelford, 2009). Based on the report to the Club of Rome (Meadows, 2013), the possibility of depletion of natural resources was raised and the idea of *res communis*, originating with Roman property rights and based on common property not being possessed by any country, was proposed as an alternative (Shackelford, 2009). According to the Antarctic Treaty, the Antarctic is a natural laboratory for all mankind. Considering its limited access and extreme environment, the international Antarctic communities have continuously requested both advanced technology and multinational research from its beginning (Fogg, 1992). In order to conduct Antarctic research, the key concern is access to transport resources including personnel and equipment. In addition, consistent logistics support to maintain research in or around Antarctica is another concern. On that account, many scholars have pointed out the necessity of international research collaboration (Aksnes & Hessen, 2009; Summerhayes, 2008). Recently, Antarctic research has moved towards international collaboration and many scholars' related Antarctic research have discussed promoting it.

In 2014, the Scientific Committee on Antarctic Research (SCAR) published a result from the Horizon Scan, a renowned method to collect predictive information in order to formulate strategies for the future. The result, being delivered from the SCAR's Horizon Scan project, was an agreement on the 80 most important scientific questions related to Antarctica, with the purpose of illustrating a scientific guideline for the next 20 years and beyond (Glenny, Grayson, Lee, & Lord, 2017). After that, the Council of Managers of National Antarctic Programs (COMNAP), formed in 1988 to gather the managers of national Antarctic programmes (NAPs) for developing and providing best practice in managing the logistics of Antarctic affairs, started the Antarctic Roadmap Challenge (ARC) project in 2016. Considering the result from the first SCAR Antarctic and Southern Ocean Horizon Scan as a guideline for *what* scientists should answer for next few decades in an agreed set of 80 highest priority questions, the COMNAP's ARC project is a framework to illustrate *how* NAPs can face the challenges of operating scientific research in order to find the answers to those questions (Kennicutt et al., 2015). As a way to enhance the capacity of Antarctic research, the idea of shared infrastructure between NAPs was proposed by the ARC project, and therefore international collaboration is one key concern for the next few decades in Antarctic affairs. As the perspective of Antarctica has changed to the place for "the common heritage of mankind", it follows that the NAPs marked the importance of international collaboration to increase both

the capacity and efficiency of Antarctic affairs.

Multinational research has successfully operated under the condition of shared infrastructure among NAPs with mutual benefits. In particular, Operation Deep Freeze, the air-link mission between Christchurch, New Zealand and Antarctica for logistic support, has been jointly operated by the USA and New Zealand since 1955 (Erb, 2011). The 60 years of stable maintenance of the air-link operation illustrates the deep partnership between all the NAPs. Since the late 1950s, the USA determined Christchurch to be a gateway city to support all Antarctic logistics. In the mid-1990s, the Italian Antarctic Program opened an office in Christchurch to support their Antarctic logistics. Furthermore, the Republic of Korea launched the Korea–New Zealand Antarctic Cooperation Center in 2014 (Harrowfield, 2017). Currently, Christchurch city hosts four NAPs, providing not just the legitimacy for the name “Antarctic Gateway” but the economic benefits of hosting transit visitors.

Each year more than a thousand Antarctic experts, including researchers, scientists and engineers, and tons of Antarctic-related equipment have transited through Christchurch to Antarctica. The Agribusiness and Economic Research Unit (AERU) from Lincoln University calculated that the aggregated direct impact on the New Zealand economy from Antarctic-related activities was approximately NZD 177.7 million in 2015 (Saunders, Guenther, & Dalziel, 2016). Compared with the data from 2013, the total amount of Antarctic-related expenditure had increased by 10%, a particularly dramatic enhancement from both the expenditure of NAPs and the tourism sectors. One reason for the change might be the establishment of the new Korean Antarctic research station on the coast of Terra Nova Bay in 2014. Due to its geophysical benefit, New Zealand has enjoyed not only international partnerships with other NAPs but economic benefits from Antarctic-related activities. Recently, the Chinese Antarctic Program officially announced that they had initiated the construction of a fifth Antarctic research station on Inexpressible Island in Terra Nova Bay in 2018 (Liu, June 28, 2018).

Considering the foundation of Antarctic research and the economic benefit from Antarctic affairs, international collaboration with other NAPs is clearly necessary. Indeed, New Zealand has had well-established collaboration with NAPs, especially those operating in the Ross Sea region, but surprisingly, collaboration with the Korean Antarctic Program has been

very limited. Considering the similar interests of these two programmes, both of them operating in the Ross Sea region, an important question is why the collaboration on Antarctic research between New Zealand and South Korea is not greater. Even if the number of multinational collaborations with South Korea has been growing recently, the relationship between Antarctica New Zealand, the primary Antarctic research in New Zealand, and the Korean Antarctic Program is still no deeper. One reason might be the difficulty in understanding the Korean perspective and finding the appropriate information.

This dissertation is basically an exploration of the Korea Antarctic Program (KAP) with the aim of promoting international collaboration with New Zealand, by suggesting various information and pursuing the understanding of KAP for more collaboration. Therefore, it is mainly focused on the development of the KAP, particularly the history of the Korea Polar Research Institute (KOPRI). It is obvious that KOPRI is the primary research and logistic institute in Korean Antarctic affairs. Even so, there are other institutes in Korea that have conducted and been operating polar research individually or cooperating with KOPRI. Chapter 2 is about the development of the Korea Antarctic Program through the past, present and future. Historically, not solely South Korea but other NAPs have discussed Antarctica with politicians' words such as sovereignty, territory, resource development, and so on. Some scholars have mentioned the controversial wording of both Korean politicians and journalists to describe the Korean perspective on Antarctica. Chapter 3 is an explanation of these perspectives and Korea's decision to march with the global trend. In addition, it is highly possible for New Zealand to have a new Antarctic partner in the Ross Sea region. The Chinese Antarctic Program (CAP) has initiated the establishment of their new research station in the region and shown their willingness to cooperate with neighbours. In light of some scholars' warnings of CAP's aggressive investment in Antarctica, it is important to learn their various perspectives on Antarctic research, and so Chapter 4 will illustrate the history of the Chinese Antarctic Program, their Antarctic infrastructure, and their different perspective on Antarctic affairs. M. M. Sorvo, was both a Russian scientist and team leader of the Soviet Union's first IGY, who described Antarctica as "the paradox of our globe" since "the scientist practiced the most advanced ideas in the most undeveloped land regarding friendship between nations" (Harrowfield, 2007). Again, the purpose of this paper is to support international collaboration through understanding both the origin of the perspective of other nations and its change.

2. The formation and current status of Korea's scientific engagement in Antarctica

E.H. Carr described history as “an unending dialogue between the present and the past” (Carr, 1892). History is not some coincidental sequence but an indicator to reflect the present and to predict the future. It is therefore important to know the one's history to understand the present and to forecast the future concurrently. Accordingly, history is the unending path from past to present to future. In order to understand the possible futures of the Korea¹ Antarctic Program, it is necessary to look at where it began and where it now stands. This chapter is an explanation of KAP's development process. The first part is a history of the Korea Antarctic Program. Obviously, KOPRI is Korea's primary research institute for polar research. Like Antarctica New Zealand, KOPRI has historically cooperated with both domestic and foreign research institute. Furthermore, some maritime or marine-related research institutes in South Korea have done polar research individually or by cooperating with KOPRI. The second part of the chapter discusses Korean Antarctic infrastructure to illustrate possible opportunities for more international collaboration. Like other NAPs, the history of KOPRI is the development of its infrastructure, which is profoundly connected with their annual budget. Even if the structure of KOPRI, a combination of both logistics and research, is different from Antarctica New Zealand's, for instance, the outcome is still related to the research budget. The last part is about the future direction of the Korea Antarctic Program. Every five years since 2007, the Korean government has officially announced its future plan for Antarctic affairs. The plan contains the next focal points, and the most recent one illustrates three focuses including the promotion of international collaboration.

¹ I realise that the use of “Korea” in the titles and terms referring to the Korean Antarctic Research Programme and its various institutions is not proper use of the English language. However, on their websites, the respective Korean institutions have had a long history of simply adding the denominator “Korea” to their names in English titles. In Korean grammar, nouns are typically strung together to form new compound nouns, and this linguistic approach has been adopted when translating terms into English. Consequently, in this dissertation, I will retain the official terms as per the Korean institutions' websites.

2.1 History of the Korea Arctic and Antarctic Research Program (KAARP)

The initial Korean approach to Antarctica was recorded in 1978, and was the operation of a krill fishery in the Southern Ocean. Under the Park Chung-hee administration, the Nambuk fishery company was requested to send their pelagic fishing vessel to examine the productivity of a krill fishery in the Southern Ocean. In 1978 they successfully harvested approximately 511 tons of krill around the coastline of Enderby Land and Wilkes Land (Jang, 2000), and its successful fishing operation led the Korean government to join in the Convention for the Conservation of Marine Living Resources (CCAMLR) in March 1985. The actual footprint was imprinted a few months later by members of Sea Explorer of Korea (SEK), a non-governmental organisation funded by the private sector. The SEK was established in 1963 and had a mission to educate Korean youth in developing a Korean maritime perspective, resembling similar institutions such as the Scout Association (National Council of Youth Organization in Korea, 2018). In the early 1980s, the Korean domestic situation was not stable, due to a regime change brought about by undemocratic methods. Despite the political turmoil, South Korea was chosen as the host nation of the 1986 Asian Games and the 1988 Olympic Games (S. R. Kim, 2011). Linked to the hosting of international events, the SEK would provoke an intrepid spirit for a brighter future for Korean youth and that was the reason why SEK decided to conduct an Antarctic expedition. Even in the preparatory stage, SEK faced a problem that the ministries of South Korea did not have any documents to support the expedition and could not provide funding for it. With the support from the Korean Embassy of the United States of America, Japan, Chile, and New Zealand and some major firms, the SEK Antarctic expedition was composed of 17 members including the captain, seven mountaineers, two scientists, and seven journalists (Korea Supporters Association for Polar research, n.d.). They had three missions: (1) to build a relationship with other stations around King George Island, (2) to conquer the peak of Mt Vinson Massif, and (3) to collect data for a potential place to build the first Korean research station (S. R. Kim, 2011).

After the successful Antarctic expedition, the Korean government tried to join the Antarctic Treaty. Even if South Korea was not a member of the United Nations in 1986, they were accepted unanimously to be the 33rd member of the Antarctic Treaty. Right after acquiring membership, the Ministry of Foreign Affairs (MOFA) reported the importance of

Antarctic studies alongside establishing a research station in Antarctica, and the president Jun Du-hwan immediately approved it. In 1987, the Korea Ocean Research and Development Institute (KORDI) launched a laboratory for the Korea Antarctic Program. A few month after its opening, the researchers from the Polar Research Laboratory nominated a few candidate locations for the first station around King George Island (Kim 2012), located in sub-Antarctica and so relatively accessible. With Hyundai Engineering, the first station was established during the austral season of 1987 and was named after King Sejong the Great, the most admired king of the Joseon Dynasty, who created the Hangul Korean alphabet. With the accomplishment of its first station, South Korea became the 23rd consultative party of the Antarctic Treaty in 1989 and the 22nd regular member at the Scientific Committee on Antarctic Research (SCAR) a year later in 1990.

In summary, Korea approached the Southern Ocean first in the late 1970s, and the Antarctic expedition team successfully set foot on the Antarctic Peninsula for the first time in 1985. The inauguration of the Korea Antarctic Research Program was made with the establishment of the King Sejong Station in the late 1980s. In a short time, the KAP finished building the logistic foundation for Antarctic science. The next step for the Korea Antarctic Research Program (KARP) was the concentration of scientific research on Antarctica. For the decade of the 1990s, KARP conducted various research programmes around King Sejong Station.

From 1999, KARP began to expand to the Arctic and conducted joint research with China and Russia in the Arctic region, which led to the building of the first Korean Arctic station at Ny-Alesund, Norway in 2002, and KARP was renamed the Korea Arctic and Antarctic Research Program (KAARP). A year later, the Korean government was concerned about the advancement of scientific research around the Southern Ocean and announced a plan to build an ice-breaking research vessel (IBRV). On that account, the Korea Polar Research Institute was launched as an affiliated institution under KORDI in 2004 and that was the time to initiate Korea Polar Research Institute (KOPRI) as an independent research institute. The next step for KOPRI was the building of the second research station. With long experience of Antarctic affairs, the Korea Antarctic Program was confident in building another base on inland Antarctica. On 1 January 2008, the actual process of shipbuilding was initiated and took almost 2 years to finish. In 2009, the IBRV *Araon*, Korea's first research vessel with ice-breaking

ability, was independently constructed using Korean technology and made the first voyage to Antarctica via Lyttelton Port of Christchurch, New Zealand. With the help of IBRV *Araon*, a Korean expedition team determined the place to build a second base, and in 2010, KOPRI announced that it would build its second research station on Terra Nova Bay. In order to facilitate the establishment of a second base, Korea and New Zealand had made an agreement on Antarctic cooperation and held the groundbreaking ceremony for the second station in 2012. The Jangbogo Station, Korea's second research station and named after a renowned admiral in the ninth century was opened in 2014, as was the Korea–New Zealand Antarctic Cooperation Centre, located in Christchurch and acting as a communication channel with Antarctica New Zealand.

2.2 Korea's Antarctic infrastructure

The history of the KARP is deeply connected with the development of infrastructure. As previously mentioned, King Sejong Station, the first Antarctic station of KAP, was built in 1988, and Dasan Station, the first Korean Arctic station, was opened in 2003. In 2009, IBRV *Araon* made a successful maiden voyage to Antarctica, and Jangbogo Station, the second Antarctic station, was opened in 2014. In brief, KAP has three research stations in the Arctic and Antarctic, and one research vessel.

Located on the Antarctic Peninsula of West Antarctica, the King Sejong Station is a research station operated year-round with 17 to 18 overwintering members. The maximum capacity accommodated during the austral season is 87. It is accessible either through the Chilean air force or by ship. The station comprises 14 parts including geodetic and geophysical observatories, two storage facilities, a power plant, fuel tanks, a satellite-tracking station, research centre, dormitory, emergency shelter and four observatories for geodetic, atmosphere and glacier, upper atmosphere, and geophysical data. Around the station, research related to climate change, marine life, the atmosphere, ozone layer, and paleoclimate has been conducted. Recently, the renovation of the station, taking the two austral seasons of 2016–17 and 2017–18, was finished, costing US\$24.4 million (USD1 = KRW1,000).

Jangbogo Station was erected on the coast of Terra Nova Bay, inland of East Antarctica, and provides better access to the South Pole. In other words, the establishment of the Jangbogo Station not only provides a geophysical benefit to access the centre of Antarctica but has also

extended the area of Antarctic research. Like the first station, it is also operated as a year-round research station with 17 to 18 members but its accommodation capacity during the austral season is 62. It is accessible by either a C-130 plane of SAFAIR, cooperating with the Italian Antarctic Program between the middle of October and late November, or IBRV *Araon* visiting Christchurch, New Zealand three to four times annually. The Jangbogo Station is split into three parts: the main building, maintenance, and independent research facilities, and it consists of 16 different buildings including a power plant and emergency power plant, a research lab, a dormitory, an emergency shelter and other buildings designed for gear maintenance, radiosondes, geophysical tests, and an automated weather-observation system. Its main research fields are space, astronomy, glaciology, meteorites, the cryosphere and climate change. Each station has a different scientific focus. Although both stations are researching climate change, their approaches are different. King Sejong Station's research is focused on ocean ecology around the shores of King George Island, and Jangbogo Station is researching glaciers and the upper atmosphere to understand climate change. King Sejong Station specialises in research into adaptation mechanisms of living organism in Antarctica, and Jangbogo Station's specialty is space research.

Initially, the Korean government decided in 2003 to build a research vessel with ice-breaking ability. After finishing the basic design, IBRV *Araon* was put into construction and was officially ready to operate its mission to the Arctic and Antarctica by 2010. The main missions are logistic support to all bases and research support in both the Arctic and Antarctic regions. With the ability of POLAR 10 – breaking a one-metre thickness of flat ice at 2 knots – it is able to carry a maximum of thirty-one 20ft containers with 85 crew and researchers. Without resupplying, IBRV *Araon* can navigate a 20,000 nautical miles in cruise distance. Since its launch, the *Araon* has annually increased the number of operational days at sea and reached 290 days of research and supply operations on average. IBRV *Araon* is off duty for less than three months each year, which are mostly spent under maintenance, and because of

which, a demand for a second IBRV has been issued and is currently being processed.



Figure 1. Annual Route of IBRV *Araon* (Source: KOPRI, n.d.a)

As previously mentioned, each station has its unique mission to support Arctic and Antarctic research, and IBRV *Araon* is operational for both logistic and research support. As shown in Figure 1, it has ordinarily operated the Antarctic expedition from late October until May and initially visited the Jangbogo Station for logistic supply. After conducting two separate scientific tours in both the Ross and Amundsen Seas, IBRV *Araon* eventually headed towards King Sejong Station in the Antarctic Peninsula for either logistic reasons or research. According to the 2017–18 *Araon* operation schedule, the total Antarctic operation days are 225 including 127 days in the Southern Ocean around New Zealand and 41 days around Chile. (KOPRI, n.d.a). In summary, the Korea Antarctic Program has connected its stations using IBRV *Araon* and cooperated with other NAPs to access Antarctica.

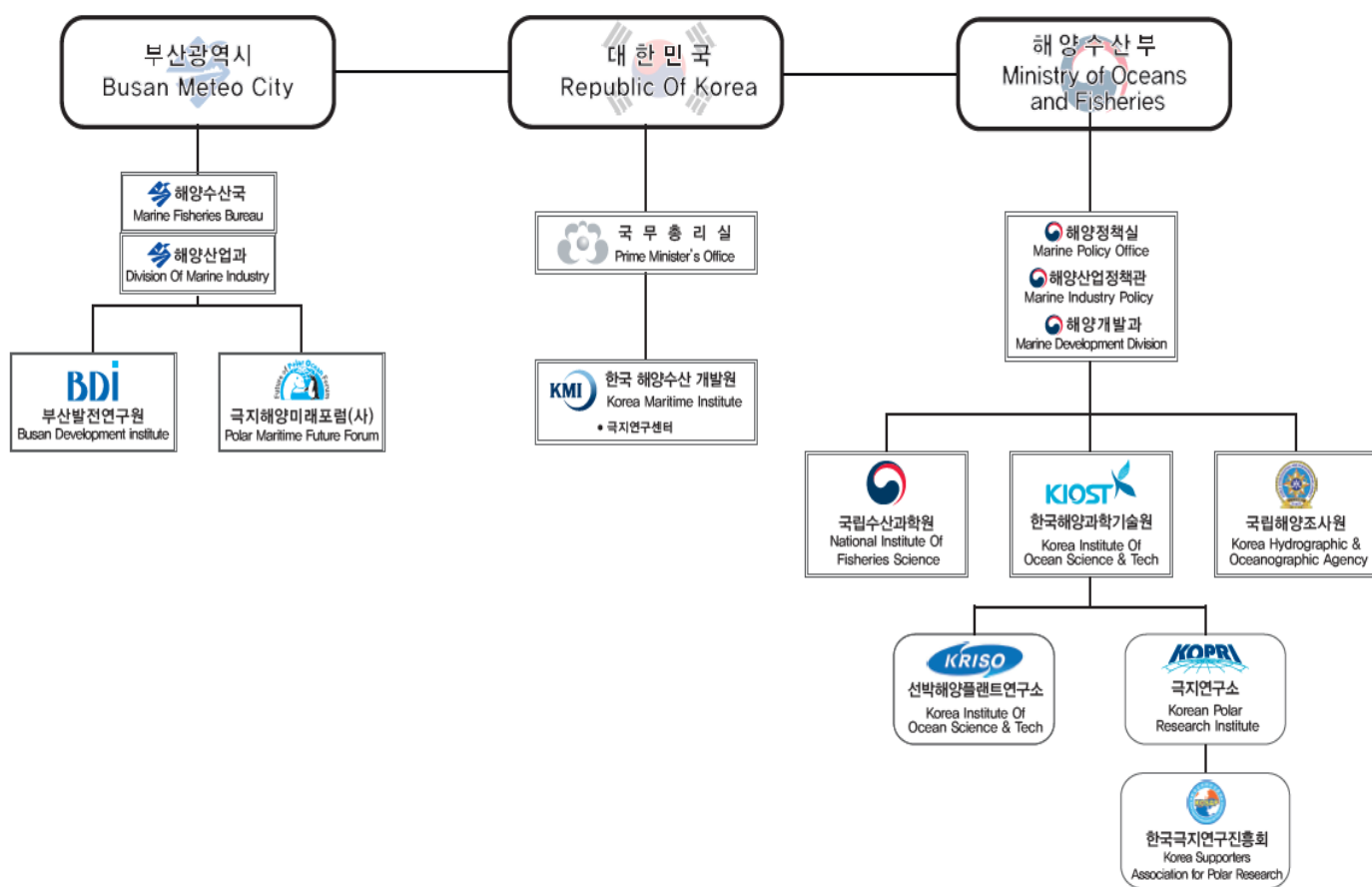


Figure 2. Korean Polar Institutes

The Korean government determined Antarctic research as high risk, high cost, and unprofitable, which required it to have a national level of support (Moon et al., 2013). Considering the role of all international organisations related to polar issues, KOPRI is obviously the primary representative organisation on both Arctic and Antarctic affairs but it is not the sole institute in Korea to undertake polar research; as shown in Figure 2, there are several institutions in Korea that have done so. Broadly, they are divided into local, legislative, and administrative branches. Alternatively, they can be divided into two parts, major and minor, based on the degree of both sustainability and financial contributions for polar research.

2.2.1 The Korea Polar Research Institute (KOPRI)

As mentioned, KOPRI is the premier polar research institute and more importantly coordinate Antarctic research across all other institutions in Korea. However, some important characteristics to synthesis here relating to KOPRI's institutional structure and function. Unlike Antarctica New Zealand, KOPRI comprises both logistics and scientific arms but the logistic parts are very much driven by the science. KOPRI's particular approach to Antarctic research can be illustrated with the example of different perspective of technology by Samsung and Apple². Still, this system allows KOPRI conduct Antarctic research autonomously. Initially the Polar Research Laboratory, the foundation of KOPRI, was established under KORDI. In 2004, KOPRI was renamed and started to function individually. Through development of Antarctic infrastructure, KOPRI currently, has three international offices for cooperation and two permanent research stations in Antarctica, one seasonal station in Arctic, and one IBRV *Araon* operating for both Antarctic and Arctic expeditions.

² Generally, the engineering team at Samsung developed advanced technology and then the design team made appropriate designs for a new product. In contrast, the design team of Apple requested the engineering team to produce what they required. Samsung would like to sell new technology to customers, whereas Apple prefers to sell comfortable technology to customers. This different perspective on technology might produce a distinctive way to develop a new product. Personally, this point shows similarities to the ways of conducting Antarctic affairs. For instance, New Zealand Antarctic research is focused on logistic support and KOPRI is focused on scientific research to figure out the logistics. This different way to approach Antarctic research could be important to promote the Korea Antarctic Program. But most importantly, both states have always tried to maximize the effect of Antarctic research within limited resources. Therefore, providing this example does not mean one approach is better than another to undertake Antarctic research.

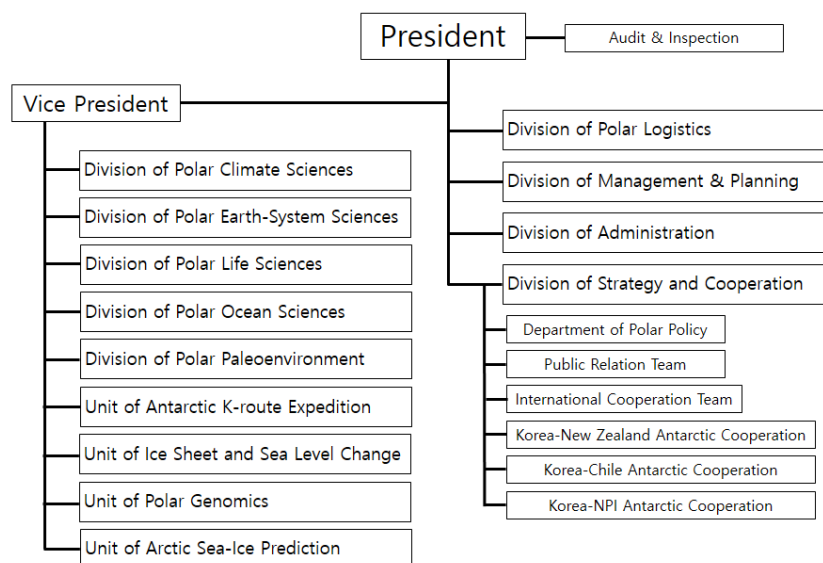


Figure 3. KOPRI Organisation Chart (Source: KOPRI, n.d.b)

Interestingly, the structure of KOPRI is combination of both research and logistics and therefore KOPRI is able to design Antarctic research and its support simultaneously. In other words, KOPRI has an autonomy in Antarctic research. As shown in Figure 3, this institute is divided and functions under two authorities: president and vice president. The research divisions are under the authority of the vice president and logistic parts are under the president's authority. The vision of KOPRI is simple "to be a global polar science institute." Based on their annual report of 2018, KOPRI has six missions and three goals. In both missions and goals, KOPRI consistently mentioned their willingness to expand their cooperation with international partners, the other NAPs in this case. Through international assessment, KOPRI examined their research capacity and their international recognition in Antarctic affair in 2009. In the same year, KOPRI proposed the K-Polar Program to promote international collaborative research with other NAPs. This programme was officially launched and operated to reinforce the network link with other advanced foreign institutes in polar research since 2010. To encourage public participation from domestic research groups in universities, KOPRI also designed the Polar Academic Program (PAP) to support domestic research groups' independent research in the polar regions. Meanwhile PAP was proposed to expand opportunities of polar research to domestic universities, K-Polar Program was promoting KOPRI's scientists to conduct more international collaboration with other NAPs. After 2014, K-Polar Program was no longer on the KOPRI's annual report. To expand global recognition of Korean polar affairs, KOPRI has

passionately worked with both domestic and international institute to expand more Antarctic research.

2.2.2 Korea Institute of Ocean Science and Technology (KIOST)

As previously mentioned, KOPRI is an affiliated institute of the Korea Institute of Ocean Science and Technology (KIOST), which is the only research institution where multidisciplinary marine subjects have been studied. Its main research areas now are issues of the global environment, protection of the environment, future resources, and maritime policies. The primary task of KIOST is to guide Korea towards achieving its mission of becoming a maritime power by pursuing “innovative and creative developments in basic and applied marine science and technology” (KIOST, n.d.a). To summarise a brief history of its foundation, its beginning was similar to that of KOPRI, which was initially founded as an affiliated institution of the Korea Institute of Science and Technology (KIST) in 1973 and started to function independently from 1990. In 2001, the institution was named the Korea Ocean Research and Development Institute (KORDI), which was later constituted as KIOST in 2012.

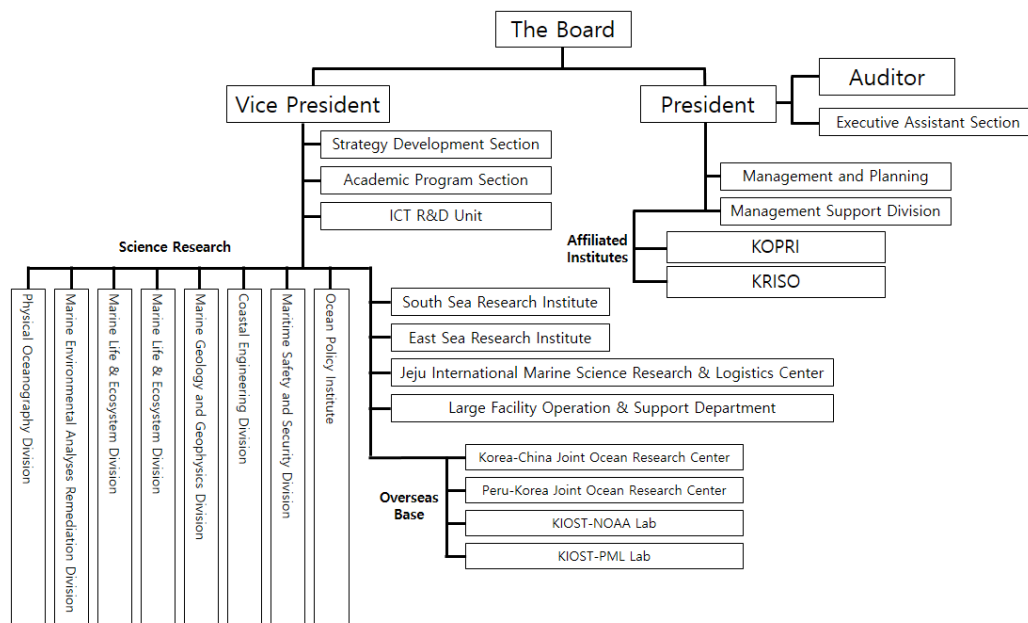


Figure 4. KIOST Organisation Chart (Source: KIOST, n.d.b)

As shown in Figure 4, KIOST has two affiliated institutes and consists largely of sections responsible for administration, logistics, science research, and overseas bases. The headquarters is located at Busan Metro City (BMC) and has operated five research centres,

institutes or stations near the coastline of Korea, and five overseas bases in China, the United States of America, the United Kingdom, Peru, and Pacific areas. Also, five research vessels (RVs), with displacements between 35 tons and 5900 tons, have been directly operated under KIOST. Recently in 2016, RV *Isabu*, having about 5,900 tons of displacement, 99.8 m length and 18 m width, with 60-passenger capacity, started to operate its mission of geophysical investigation, sub-bottom structure exploration, and marine resource survey. Including permanent, temporary, and contractor positions, the KIOST currently has 879 staff and its annual budget in 2017 was about US\$175 million (USD1 = KRW1,000) with an average budget over five years of US\$200 million per year (ALIO, 2019b).

The three main divisions related to polar studies in KIOST are oceanographic observation, climate modelling and policy analysis. In order to calculate thermal fluxes across the Antarctic circumpolar current (ACC), KIOST worked jointly with a French research team using IBRV *Araon* in February 2016. They set up a recording current meter at Udintsev Fracture Zone, to the east of New Zealand in the Southern Ocean and monitored the current data for two years. In addition, surveying the ACC's volume of traffic and researching the vertical mixing in the Drake Passage have been conducted with the French team on IBRV *Polarstern* between 2006 and 2009.

2.2.3 Korea Research Institute of Ship and Ocean Engineering (KRISO)

The Korea Research Institute of Ship and Ocean Engineering was established in 1973 and became an affiliated institute of KIOST in 2014. Currently, KRISO is located at BMC and

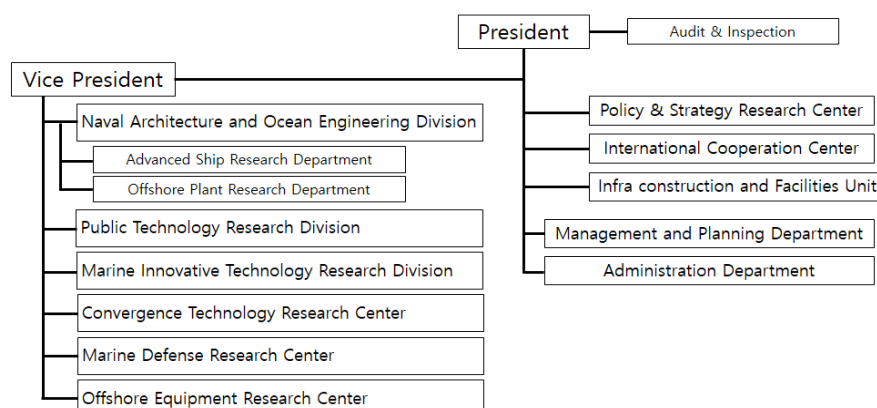


Figure 5. KRISO Organisation Chart (Source: KRISO, n.d.a)

has 388 staff. In 2017, its annual budget was approximately US\$127 million (USD1 = KRW1,000) and the average of the last four years was US\$94.1 million (ALIO, 2017).

As illustrated in Figure 5, this institute is divided into three distinct sections: science research, infrastructure and administration. Under the control of a vice president, KRISO has three divisions and three research centres. Each division consists of two departments: in terms of polar-related research, the Advanced Ship Research Department of KRISO has mainly focused on developing the technique of safe navigation on polar seaways and an evaluation method to check ice-breaking ability at extremely low temperatures.

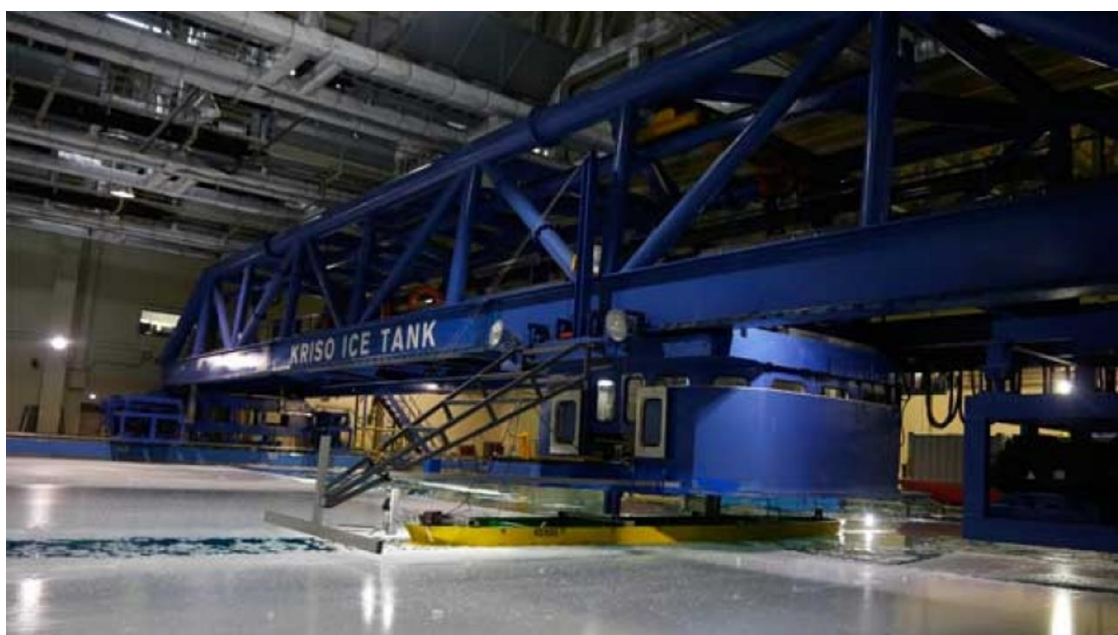


Figure 6. KRISO Ice tank (Source: KRISO, n.d.b)

In terms of its research facilities, KRISO currently has multiple types of research facilities including two types of tanks to test ship performance in certain conditions, two different size of cavitation tunnels, one hyperbaric chamber, and a deep-seabed mining laboratory. In particular, in June 2010, KRISO initiated the building of an ice tank to imitate the condition of the frozen sea for testing navigation systems in the polar environment; it was finally constructed in May 2010. The dimensions of the ice tank (see Figure 6) in KRISO are 32 m long, 32 m wide, and 2.5 m deep. It includes two cold rooms, 5 m long, 4 m wide, and 2.5 m high. In addition, the lowest temperature for the ice tank is -30°C , and for cold rooms is -50°C . Indeed, this facility helped to test the IBRV *Araon* for ice resistance in its ice-breaking ability. To facilitate the use of the ice tank, KRISO has undertaken studies, including: (1) model test

of any ice-breaking or ice-resistant vessels including development of its analysis method; (2) full-scale trial of ice-type vessels; (3) building a database on ice sheets, glaciers and polar conditions; (4) model test of polar offshore plant; and (5) performance test for vessel equipment at extremely low temperatures (KRISO, n.d.b). In response to the Polar Code of 2017, the Advanced Ship Research Department has been assigned the development of a safe navigation system on the North Pole route from November 2014 for five years.

2.2.4 Korea Maritime Institute (KMI)

In February 1984, the Korea Shipping Technology Institute was initially opened, changing its name to the Maritime Industry Research Institute in December 1988. In April 1997, the government of Korea announced its willingness to consolidate the maritime and shipping, marine, and fisheries policy-related divisions scattered throughout various institutions in Korea and therefore the Korea Maritime Institute (KMI) was finally founded with its current organisational structure. Based on the Act on the Establishment, Operation and Fosterage of Government Invested Research Institutions (KMI, n.d.a), KMI became the one of 26 affiliated institutions related to economics, social science and humanity studies under the Prime Minister's Office.

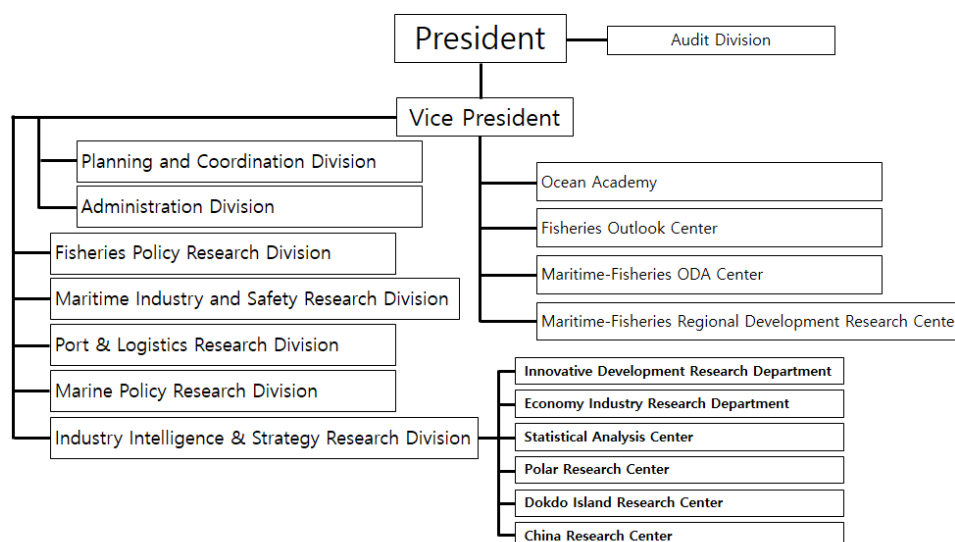


Figure 7. KMI Organisation Chart (Source: KMI, n.d.b)

As illustrated in Figure 7, the KMI has seven divisions including five research-related divisions and two administrative divisions. Also, the KMI has separately operated Ocean

Academy, the Fisheries Outlook Center, the Maritime-Fisheries Official Development Assistance (ODA) Center and the Regional Development Research Center, because they are directly assigned projects by ministries. In addition, the KMI opened the China Research Center at Shanghai. In terms of polar-related issues, the Polar Research Center's Strategy Research Division has mostly focused on Arctic issues. Annually, the KMI has held the Arctic Academy, inviting scholars from Arctic regions, and has collaborated with Korean students, as well as jointly hosting the Arctic Partnership Week with KOPRI, the National Maritime Museum and other Arctic-related institutes in Korea.

Since 2015, the KMI has operated a short-term educational programme to promote potential polar experts and has sent three to five graduate students to universities in Arctic and Antarctic regions. For instance, they sent three students in 2016 and six students in 2017 to the University of Canterbury, New Zealand and those students partially participated in the Postgraduate Certificate in Antarctic Studies for three weeks.

Another important task is sharing information with the public. Since 2016, KMI has facilitated the Korea Polar Portal website to provide multidisciplinary subjects related to polar issues and has sent monthly Polar Newsletters to announce the latest issues concerning the Arctic and Antarctica. To assist in devising laws related to polar issues, KMI has researched the previous enforcement ordinances and implementation plans in Korea for the Arctic and for Antarctica. Building on know-how and experience from previous polar-related research, KMI is planning to develop some appropriate Arctic policies for the Korean government and eventually develop some programmes for international collaboration on Antarctica.



Figure 8. Research Institutes under NIFS (Source: NIFS, n.d.)

2.2.5 National Institute of Fisheries Science (NIFS)

In its first stage, this institute was begun as a fisheries experimental station in 1921 and launched as the National Fisheries Research & Development Agency (NFRDI) under the Ministry of Agriculture in 1963. Finally, NFRDI was renamed the National Institute of Fisheries Science and was moved to the Ministry of Oceans and Fisheries in 2015. The NIFS is the research organisation that studies the development of fisheries in littoral and pelagic regions, surveys the marine environment, manages domestic marine resources, and promotes farming technology in fisheries. The headquarters are located at Busan and the affiliated six fishery research institutes and eight special research centres are scattered around the coastline of South Korea (Shown on Figure 8).

Currently, the NIFS operates 11 RVs, with displacements between 9.77 tons and 999 tons. Of the RVs belonging to NIFS, most are small ships of less than 100 tons and only two of them

have gross tonnage more than 800. The newest and largest, RV *Tamgu* (*Research* in Korean), the 21st of the NIFS research vessels, was launched in March 2015.

Since marine-resource-related research is a key area of NIFS research, NIFS has consistently researched Antarctic krill; this is not just an important ecological indicator in the Antarctic marine ecosystem but also has economic aspects in Korea for the distant water fisheries industry. According to “Krill Report of 2016” (Commission for the Conservation of Antarctic Marine Living Resources, 2017), the total krill catch worldwide was 260,174 tonnes and South Korea caught 23,073 tonnes, which is about 8.9% of the total krill catch. The size of the krill catch has rapidly increased and was recorded as 34,506 tonnes in 2017 (CCAMRL, 2017 and Statistics Korea, 2018). In fact, South Korea is ranked among CCAMLR members as having the third-longest history of krill fisheries and the largest krill catch in the years between 2005 and 2015 (CCAMRL, 2017). Therefore, the Distant Water Fisheries Resources Research Division collaborated with Chonnam National University in conducting an acoustic survey of Antarctic krill in 2016. Between 13 and 24 April 2016, they conducted a survey on the *Kwang Ja-Ho*, a commercial fishing vessel, and used the two-frequency difference method to estimate the distribution and density of krill around South Shetland Island (Choi et al., 2017). In June 2016, the Distant Water Fisheries Information Analytical Laboratory was opened to monitor the status of the fishery in real time and to predict the potential catch using statistics. In this way, the Korean government possibly prevented some illegal fishing on the Southern Ocean (NIFS Press Release, 2016).

2.2.6 Korea Hydrographic and Oceanographic Agency (KHOA)

Initially, this institute was started as the Hydrographic Division under the Operations Department of the Korea Navy in 1949, and the Hydrographic Division was relocated to the Ministry of Oceans and Fisheries and then referred to the Korea Hydrographic and Oceanographic Administration in 1996. KHOA has conducted maritime observation and hydrographic surveys to secure safety on both domestic and international water routes and they have therefore scrutinised domestic ports and watercourses and designed accurate hydrographic maps to support all maritime activities (KHOA, n.d.b).

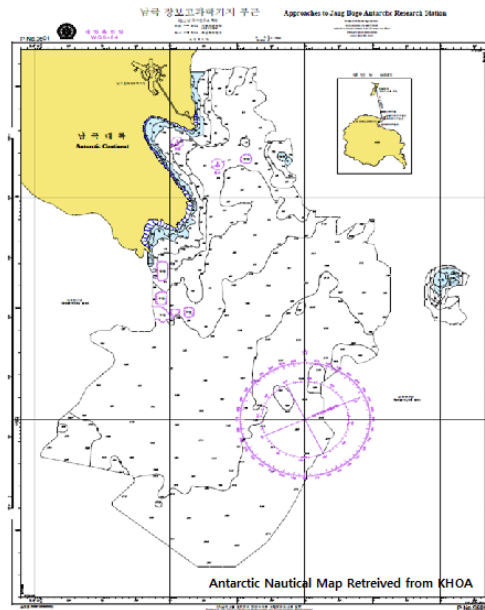


Figure 9. Approaches to Jangbogo Antarctic Research Station (Source: KHOA, n.d.a)

In 2013, the KHOA signed a Memorandum of Understanding (MOU) with KOPRI to construct an Antarctic hydrographic map with Korean place names (Ministry of Ocean and Fishery, 2015). As a result, they designed the Antarctic nautical chart around Jangbogo Station in 2014. Due to the absence of accurate nautical charts of Antarctica, some Korean commercial vessels faced marine accidents in the Southern Ocean. Since 2016, the KHOA, in collaboration with KOPRI, has been working on a five-year project to design a new nautical map of the Ross Sea (MOF, 2018).

2.2.7 Busan Development Institute (BDI)

To prepare for the decentralisation of the Korean government and for the globalisation era, Busan Development Institute (BDI) was opened as the Southeast Development Institute in August 1992. The name of the organisation was changed to BDI in 1994 and consolidated with the Policy Strategy Office of BMC in 2003. It is a regional think tank to analyse and to promote the quality of life for Busan citizens. Because of melting Arctic ice, the possibility of using the Arctic route to Europe has been discussed, and Busan, the biggest harbour city in Korea, has shown its willingness³ to become a Polar Gateway city. Finally, the BDI opened the Arctic

³ Historically, Busan Metro City is famous as both a harbour city and a shipping industry Mecca. Unfortunately, the shipping industry has been suffered of long economic recession. Suffering long term economic recession in shipping industry, BMC has passionately promoted the development of other shipping market in oversea. In 2014,

Research Center and released a basic plan to construct Busan Polar Town in 2017 (Busan Development Institute, 2017).



Figure 10. Busan Polar Town in Aerial View (Source: T.Kim, 2017)

The project of Polar Town was planned to take advantage of the geophysical benefit of being a Polar Gateway city and to locate polar-related research infrastructure in Busan (BDI, 2017). The idea of constructing a Polar Town is simply to provide synergies by integrating all research, the port, education, the library, an attraction, and museum related to polar affairs into one location. In fact, BMC has already secured the potential site for the Polar Town, which is about 23,000 m² and the total cost was calculated as US\$162.7 million (USD1 = KRW1,000; US\$72.1 from government expenditure). At this stage, this project has been announced by BMC but is still under discussion with the Ministry of Ocean and Fisheries (T. Kim, 2017).

2.2.8 Korean NGOs and their role in enhancing public awareness about Antarctica

On behalf of the Korea Antarctic Research Program (KARP), the Korea Supporters Association for Polar Research (KOSAP) and the Polar Maritime Future Forum (PoF) have

Daewoo Shipbuilding & Marine Engineering had won a contract of 15 LNG ships with ice-breaking capacity for Russia's Yamal LNG project. Recently, South Korea was interest in the possibility of opening a new North Pole Route or the Arctic route. In addition, China's Belt and Road Initiative and its improving relationship with North Korea provoked South Korea to shift the paradigm toward the Arctic Ocean. Moving with the new paradigm, BMC officially announced their willingness to obtain the recognition as a 'Polar gateway city' and built a relationship with Christchurch, the Antarctic gateway city in 2017.

promoted public awareness of Antarctica. In 2005, KOSAP was established with the permission of the Ministry of Ocean and Fisheries and PoF was founded jointly with Busan University, Pukyong National University, Korea Maritime and Ocean University, Busan City Board of Education, and Kookje Daily News, and has been mainly funded by Busan Metro City since 2014. Both organisations (KOSAP and PoF) are non-profit incorporated associations, which are similar to the system of public-private partnerships in New Zealand. Their primary task is public relations about Antarctica from different angles. KOSAP is focused on publication of both video and magazines and has also hosted an annual essay contest and exhibition related to the Arctic and Antarctica. To support documentary producers, KOSAP has released a documentary film annually, and distributed about 20,000 DVDs to educational organisations in Korea.

In terms of magazine publications, editors of KOSAP have published a magazine – “Polarian for the Future” – twice a year to all elementary, middle and high schools in Korea, including public libraries. Since 2010, an annual essay contest related to polar issues and a polar exhibition have been held in Korea.

The PoF has focused on educational programmes to educators and youth. Since 2014, PoF has held Polar University educational workshops for school teachers and invited polar scholars from KOPRI to teach school teachers from Busan. Also, each year, they have recruited and trained Polar Curators from former and current school teachers. The main task of Polar Curators is delivering a short lecture to any public educational organisation. In addition, the PoF has conducted both photo and book report competitions annually since 2015. Once Busan Metro City and Christchurch City Council had signed the MOU for Polar Issues in 2017, the PoF of Busan Metro City and the Antarctic Office of Christchurch City Council were assigned a communication channel. As a response to Section (d) from the Polar Issue MOU, two Antarctic scholars from the Canterbury region were invited to introduce Antarctica at the International Conference on Arctic Vision 2017: Arctic Meets Antarctica.

2.3 Annual Budget and its relationship with outcome

Due to the enhancement of its infrastructure, the annual budget of KAP has rapidly increased. Since the foundation of KOPRI, the slope of the annual budget graph (Figure 11) is obviously connected with the development of infrastructure. The first change appeared in 2003

and relates to the opening of Dasan Station. The slope has risen steeply because of IBRV *Araon*'s construction between 2004 and 2009. In 2012, the establishment of the second station was initiated, and it was finished in 2014. It is interesting, too, that the grant for research projects has been consistently increased with the total budget. In fact, the reason to develop new infrastructure is primarily to advance scientific research in Antarctica.

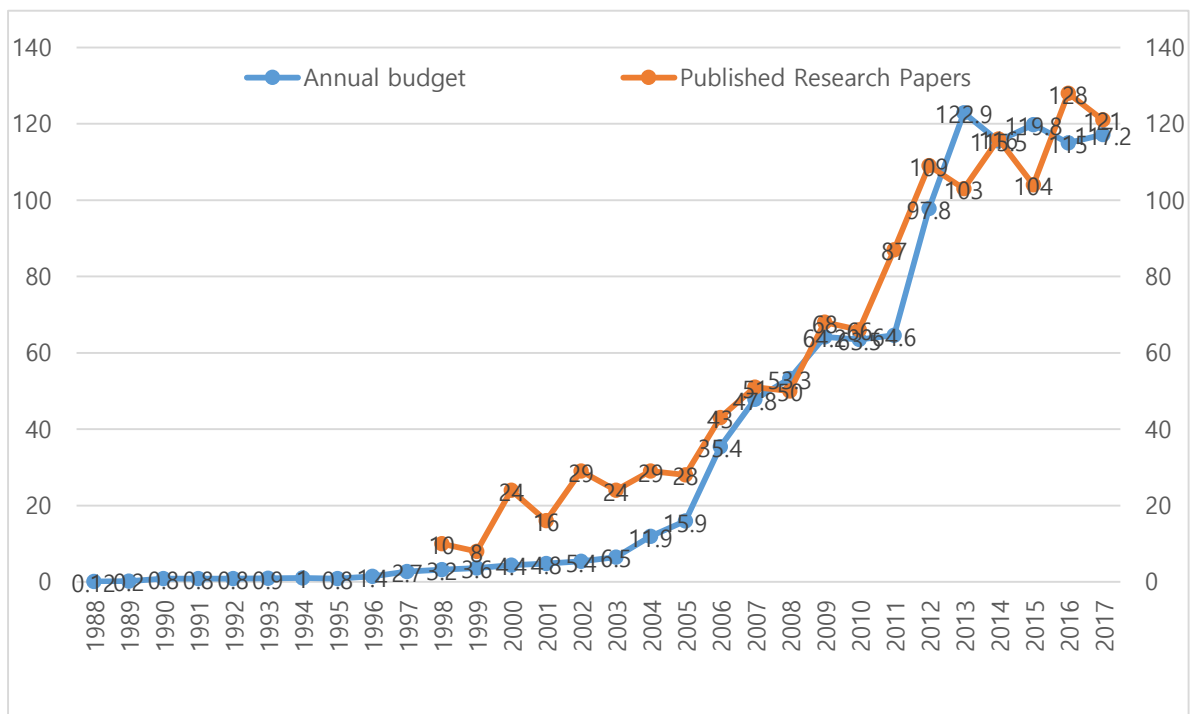


Figure 11. Annual budget of KOPRI and Antarctic research publications since 1988 (Source: BDI, 2017; D. Jang, 2016)

South Korea has rapidly developed its Antarctic-related infrastructure and this is consequently reflected in the annual budget. As shown in Figure 11 the annual budget of KOPRI has rapidly increased since 2003. Each radical enhancement was brought about by the development of infrastructure, and it is inevitable to conclude that the annual budget has a direct relationship with the infrastructure development. Considering that the operational budget is part of the annual budget, it is logical that the development of infrastructure is closely related to the total budget. Still the primary concern is how this enhancement of the annual budget has brought about this outcome. First, it is important to define what the meaning of outcome is in scientific research. Previously, several scholars have determined the quantity of articles as the outcome and retrieved the data from credible websites, using keywords. To evaluate the outcome from international collaboration and to understand the trend related to polar studies, some quantitative research, using bibliometric analysis, has been done, with the outcome

related to polar studies since 2008 (Aksnes & Hessen, 2009; Dastidar & Ramachandran, 2008; Duckhee Jang, Yong-Jin Choi, & Jin-Young Kim, 2016; Ji, Pang, & Zhao, 2014). Recently, Choi et al (2016) decided to use the 78,445 articles, retrieved from Science Citation Index (SCI) database, between 1998 and 2015. The Web of Science, produced by Thomson Reuters, has the problem that 41% of the authors' institutes or nationalities were omitted during the period from 1984 to 1997. As a result, the researchers decided to use the data after 1998 (Duckhee Jang et al., 2016). As previously demonstrated, excluding the data before 1997 illustrates that there is a relationship between the number of articles and annual budget (see Figure 10). Moreover, the annual budget is, indeed, the sum of all categories of budget. It is interesting, though, to study which categories of budget would have more influence over the outcome. Generally, the productivity of outcome is deeply connected with the personal cost. It is logical that the increasing employment of researchers might promote the publishing rate of articles.

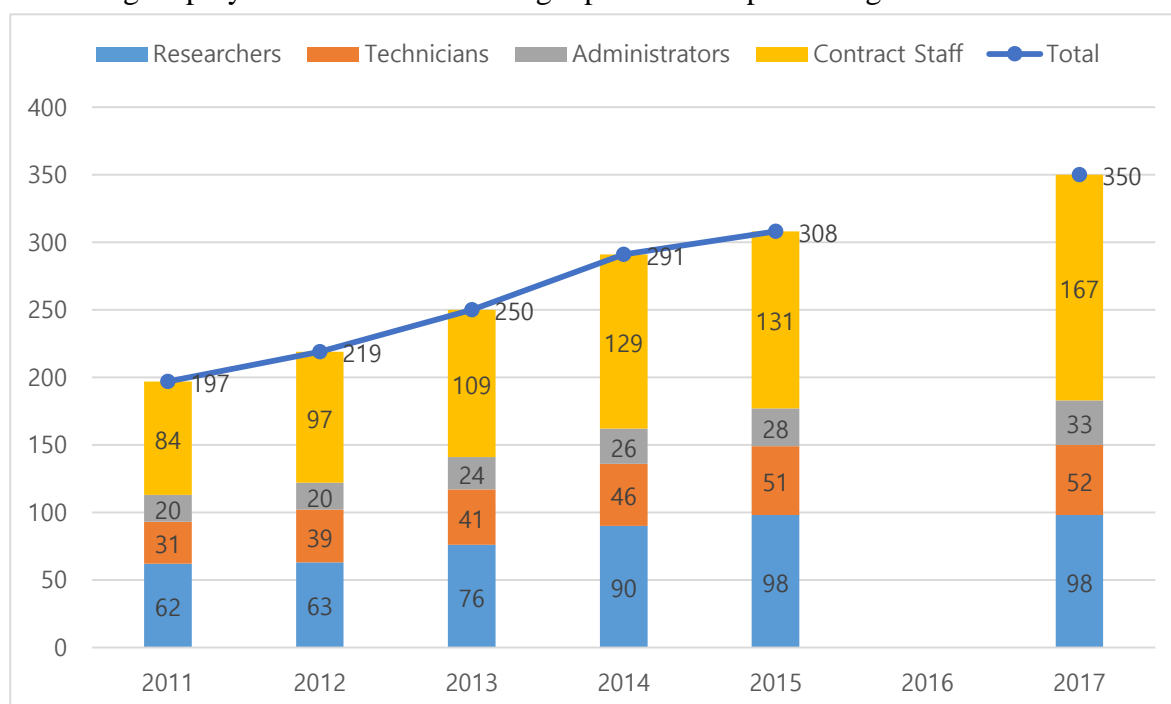


Figure 12. KOPRI's Number of Employees since 2011 (Source: BDI, 2017; ALIO, 2019a)

As shown on Figure 12, KOPRI currently has linearly escalated their employment since 2011. Simply, the staff of KOPRI are categorised into four groups – researchers, technicians, administrators, and contract staff. Combined with the data from the BDI report

(2017) and ALIO⁴ (2017), the average of total employment has increased by 12.2% including 9.9% in research, 7.5% in technicians, 13.5% in administration, and 14.9% in temporary positions over six years (2011–2017). Despite the lack of data from 2016, it is evident that the KOPRI's employment has gradually grown, especially in terms of the researchers; meanwhile Figure 11 shows that there has been a rapid change in the number of articles.

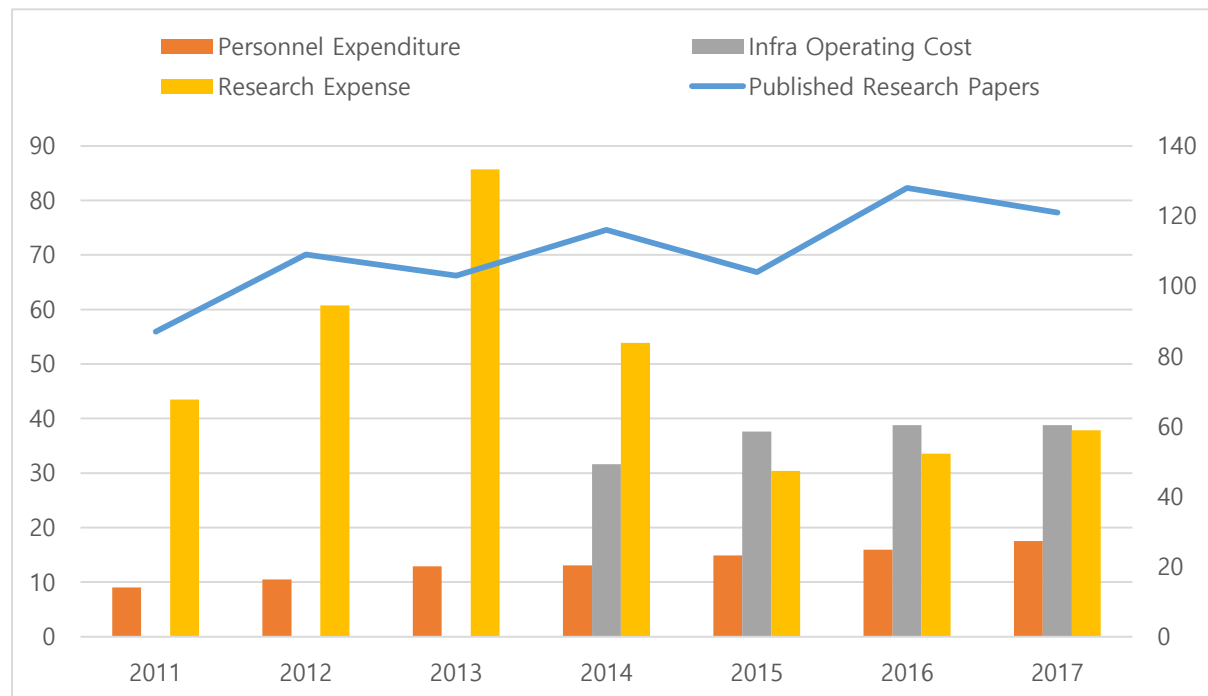


Figure 13. A comparison between KOPRI's annual budget and research outputs (Source: BDI, 2017; D. Jang, 2016)

Another possibility is that the operational budget would be an influential factor in increasing the outcome. To conduct efficient research on Antarctica, some advanced technologies are required to survive the extreme environment (Fogg, 1992). In fact, lack of access and difficult logistics have demanded international collaboration among Antarctic scholars from the beginning (Summerhayes, 2008). Accordingly, the logistics, related to the operational budget, are definitely one of the key factors in determining the outcome; yet the pattern of the operational budget is shown differently in Figure 13, and therefore the research budget shows relatively closer connectivity with the outcome. In comparison with other budget categories, the research budget showed closer connectivity with the outcome than the others did. Besides its relationship with the outcome, its value as a proportion of the total budget is

⁴ ALIO is an on-line system that allow public to access into information of public institutions.

marked. In addition, the amount of investment on Research has been rapidly increased and some scholars consistently surveyed about its effectiveness. Based on KOPRI's annual reports since 2008, the average of the research budget is about US\$53.3 million (US\$1 = KRW1,000) and the average research budget per researcher is approximately US\$0.8 million. The investment on research budget per Antarctic scholars are enormous. Accordingly, some of Korean scholars have studied about its efficiency and suggested that international collaboration with other NAPs would promote the efficiency.

Another interesting factor from the annual budget is the proportion spent in the research budget⁵. Between 2011 and 2017, the minimum research budget as a proportion of the total budget is 56.8% (year 2015) and maximum is 76.3% (year 2014). On average, the research budget was 65.6% of the total over seven years. In other words, the research budget has occupied two-thirds of the total budget since 2011. Furthermore, the Korea government recently announced a plan to double the basic research⁶ budget to about US\$1.2 billion in 2017 between 2017 and 2022 and to reinforce the autonomy of researchers (G. Park, Shing, Yang, Jung, & Oh, 2017). In practice, the research divisions of the institutes have individually contacted their counterparts in other foreign institutes to conduct international collaborations. After the Letter of Intent (2014) to open the KR–NZ Antarctic Cooperation Center, only one official document has been made with any New Zealand institution since 2014. Recently, the Letter of Understanding (LoU) was signed in January 2018 with National Institute of Water and Atmospheric Research Ltd (NIWA). On the LoU, KOPRI and NIWA have an understanding to facilitate cooperative research on the Ross Sea to provide access to RV Tangaroa, operated by NIWA, during the 2018 voyage. Without formal documentaries, several scholars from New Zealand Antarctic-related institutes have cooperated with KOPRI to conduct research activities in Antarctica. For instance, KOPRI has supported research activities by NIWA and New Zealand Antarctic Research Institute around Cape Hallett since 2017. In order to expand international collaboration with Korean Antarctic Program (KAP), it is

⁵ Infrastructure Operating Cost was included in research budget before 2014. Therefore, there was rapid downfall in 2014.

⁶ Basic research refers to pure science as compared to more applied research in e.g., engineering, medicine, agricultural science, etc.

necessary to understand the KARP.

2.4 Strategic direction in Korea Antarctic Research

To globalise⁷ both the Antarctic Treaty and Environmental Protocol, South Korea legislated the Act of Antarctic Affairs and Environmental Protection (Antarctic protection law) in 2004 (S. Park et al., 2012). The law is based on the frame of both the Antarctic Treaty and Environmental Protocol and is targeted to regulate and legally protect Korean activities in Antarctica. This act was jointly enacted by three ministries – the Ministry of Environment, MOFA, and Ministry of Ocean and Fisheries (MOF) and chiefly aimed to protect and preserve the Antarctic ecosystem. Fundamentally, the Act is composed of six chapters with 27 provisions and contains general rules, permissions for Antarctic activities, protection of the Antarctic environment, nomination and activity of monitoring members, promotion of Antarctic affairs, and penalties. Based on Chapter 5, Provision number 21 of the Antarctic protection law, the government has established and enforced the Antarctic Research Activity Promotion General Plan (Five-Year Plan) from 2007, and in 2017 South Korea announced the third Five-Year Plan (period from 2017 to 2021).

Table 1. The MOF's process towards creating its third Five-Year Plan (Source: MOF, 2017)

May 2016 – Nov. 2016	To assign research survey to build 3 rd Five-Year Plan and to hold the advisory committee
Sept. 2016 – Oct. 2016	To conduct the demand survey for Antarctic affair for next five years
Nov. 2016	To host a conference with relevant Ministries to establish the 3 rd Five-Year Plan
Feb. 2017	To hold a public hearing about the 3 rd Five-Year Plan
April. 2017	To announce the final version of 3 rd Five-Year Plan for the period between 2017 and 2021

⁷ *Glocalise* is a portmanteau word of *globalization* and *localization* to describe a phenomenon where a product or service that is distributed globally and successfully adjusts into local market. For instance, McDonalds is a global franchise and has developed and provided special menus for local consumers only

In order to build the Five-Year Plan, the MOF, as the managing ministry, assigned the research survey to KOPRI and concurrently formed an advisory committee with eight Antarctic experts. Second, MOF also requested that KOPRI conduct a demand survey for Antarctic affairs for the next five years, and 150 participants from domestic research institutes, universities, forums, and industries related to Antarctica have submitted. After printing a draft version of the Five-Year Plan, MOF eventually hosted the conference with relevant Ministries: the Ministries of the Environment, Foreign Affairs, and Science, ICT and Future Planning. Before announcing the results to the public, MOF also held a public hearing to check the public opinion about a third Five-Year Plan.

Finally, in 2017, the Korean government released the newest Five-Year Plan. The first Five-Year Plan, between 2007 and 2011, mainly aimed to expand Antarctic-related infrastructure and strengthen basic science research activities; the second, between 2012 and 2016, similarly aimed to develop Antarctic infrastructures and promote Antarctic studies. As a result, KAP successfully launched and operated new Antarctic-related infrastructure like IBRV *Araon*, and Jangbogo Research Station. Still the goal of the second Five-Year Plan was to become one of the top seven NAPs in Antarctic studies and to promote applied science in Antarctic studies. Examples of some remarkable outcomes include IBRV *Araon* having rescued distressed ships in the Southern Ocean several time and its rescue missions not only having illustrated the duty of humanity in diplomatic areas but also leading to the building of an Emergency Operations Room, that is, a control tower to check all logistic operations, the health status of researchers, and the current weather status on site (KOPRI, 2015). Additionally, KOPRI has fulfilled the basic science activities, particularly in the study of the cryosphere, meteorites, and atmosphere, and has initiated the Polar Genomics unit to promote applied science. To put it another way, both the first and second Five-Year Plans are considered as cumulative stages to enhance the capability of KAP, while the third Five-Year Plan is at the developmental stage for KAP to be one of leading states in Antarctic affairs.

Table 2. The focus of MOF's third Five-Year Plan (Source: MOF, 2017)

Strategies	Activities emphasised
Expansion on Antarctic studies	To predict and to resolve the problem of climate change through Antarctic studies
	To find access to the untrodden regions of inland Antarctica
	To promote multidisciplinary research as a response to the fourth industrial revolution
Advancement on Antarctic logistics	To advance both the safety protocol for Antarctic affairs and Antarctic infrastructure
	To develop the education system and public awareness about Antarctic studies
Antarctic governance	To strengthen foreign partnerships through international collaboration
	To illustrate leadership among NAPs to protect the Antarctic environment through scientific research

The basic direction of the third Five-Year Plan has three different perspectives. From the scientific perspective, the direction should be flexible to liaise with previous studies and to discover new areas of applied science for tangible achievement. From a logistic perspective, it should contain an efficient way to utilise current Antarctic infrastructures and the consideration of a third research station on Antarctica. Lastly, the direction should be towards the contribution to environmental protection for the international community. Therefore, the third Five-Year Plan has a vision of leadership acquisition in Antarctic affairs through contributions to resolve common problems of the international community, and chiefly contains three strategies with seven promotion activities.

For the next five years, KAP will focus on scientific research related to climate change through studying the cryosphere, glaciers, and ice cores, and monitoring the Antarctic ecosystem. Also, the K-route project, for a 3,000 km inland route towards the South Pole, is one of the major projects to expand new areas of scientific research. As with the fourth industrial revolution, the extreme conditions in Antarctica are suitable as a test bed to promote robotics, radio communication, and autonomous-drone industries. In order to secure safety in Antarctic affairs, KAP will develop both the customised safety manual for each station and the emergency evacuation plan. For advancement of infrastructure, the second IBRV is at the stage of its feasibility study and the possibility of constructing a third research station in inland

Antarctica is at the examination stage. Most importantly, the Antarctic governance strategy is related to not only the leadership role from the vision of the third Five-Year Plan, but also illustrates the change in government perspective on Antarctica.

3. Critical perspectives on the development and status of Korea's Antarctic research landscape

The Korea Antarctic Program has about three decades of history since 1987. Despite a relatively short history compared with New Zealand's Antarctic research, the radical investment in KOPRI is still notable in Antarctic research history. In particular, the last 15 years of KOPRI's history illustrates the rapid growth in both its annual budget and published research papers related to Antarctica. Now, KOPRI has three research stations in Polar Regions, three international offices, and one research ship with ice-breaking capability. Accordingly, KOPRI has broadly shown their interest in international collaboration with other NAPs through sharing their Antarctic infrastructure. The development of infrastructure not only means physical structure but also the setting up of the government's Antarctic strategies. Every five years, South Korea has carefully determined the future direction of Antarctic research and the most recent guidance is the third Five-Year Plan, which stressed the importance of international collaboration for the next five years.

It is possible to misunderstand the foundation and progress of the Korea Antarctic Program through the perspective of both Korean politicians and journalists. Considering the general preference of both politicians and journalists in Korea, the words of sovereignty, territory, and natural resources were provocative and even incendiary remarks to ordinary tax payers in South Korea. But the perspective of Antarctic scholars in Korea was different, since from the beginning, the consistent guideline, pursued by those scholars, has changed the government's perspective on Antarctica. This thesis is going to show the shift in government perspective and South Korea's research and development (R&D) investment towards international collaboration. In addition, the Antarctic relationship between New Zealand and South Korea will be briefly introduced at the end.

3.1 The dichotomy between the government's and the scientists' perspectives on Korean Antarctic Research

The year of 2018 is the 30th anniversary of King Sejong Station, the first Korean research station, established in February 1988. Among Antarctic Treaty members, the Korean Antarctic Program has a relatively short history but its speed of development in Antarctic

affairs is quite remarkable. As previously explained, all of KAP's achievements in Antarctic affairs have been acquired in three decades. In my opinion, there have been two distinctive perspectives of politicians (including media) and of scholars since the beginning of the prosperity and progress of the Korea Antarctic Program. According to Kim (2011), the different political stands of each administration have tried to colour the Korean Antarctic strategy with their political position, even if the core of it has remained constant.

The origin of the Korean Antarctic Program began with krill fishing in 1979 and the fishery was a response to the political need, under the Park Chung-hee administration, to find a new way to provide protein at a lower price (S. R. Kim, 2011). To distract the public willingness towards democratisation in 1987, the Jun Do-hwan administration used the Antarctic policy in the same way as they used the "3S" (Sex, Screen, Sports) policy, since his Antarctic policy was a short-term goal to flaunt his statecraft for his legitimacy (S. R. Kim, 2011). It is true that Jun Do-hwan might have used the success of the Antarctic expedition for his political legitimacy. Contrary to Jun Do-hwan's assertion about the Antarctic expedition, the Sea Explorer of Korea (SEK) independently organised the expedition and could not get financial support from the Jun administration. However, each presidency has used Antarctic policy to make propaganda for a positive image of their political legitimacy. In fact, the Korean government and media have consistently mentioned controversial words, such as sovereignty, development, natural resources, and so on, in discussing Antarctic affairs.

Even if the third Five-Year Plan has illustrated a change of governmental perspective, leaning towards international collaboration, the same wording, unfortunately, still exists in politician's speech and in the news. On a positive point, politicians have started to use words ambiguously: recently, President Moon Jae-in and Minister Kim Youn-choon, from the Ministry of Ocean and Fishery, made congratulatory messages for 30th anniversary of King Sejong Station. In President Moon's address, he particularly commended the research achievements of discovering gas hydrate and studying climate change with the World Meteorological Organization. Then he mentioned his expectation of seeing innovative outcomes from climate change research, and resource development for the future. Also, Minister Kim literally described Antarctica as a vast laboratory hiding the secret of climate change and marine ecosystems, and the opportunity for it to contain an incalculable amount of natural resources.

Accordingly, both addresses, made by the president and the minister, mentioned the word “resources” in describing Antarctica. Being poor in terms of natural resources, Korea’s thirst for natural resources was not surprising. Describing South Korea’s strategic interest in Antarctica, S. R. Kim (2011) actually insisted that South Korea has focused on both the Arctic and Antarctica to secure energy sources because of the scarcity of domestic natural resources. In addition, South Korea has investigated the existence of natural resources, particularly fossil fuel, in Antarctica (S. R. Kim, 2011), and Y. Kim and Kwon (1996) studied Antarctic petroleum in 1996. Interestingly, they showed that the possibility of developing nonrenewable resources in Antarctica has increased due to technology advancement, but consequently, an international movement to ban the exploitation of natural resources in Antarctica has emerged. Finally, global concern for environmental protection contributed to the Protocol on Environmental Protection to the Antarctic Treaty (also known as the Madrid Protocol) in 1991. In line with the international trend, they pressed for a national policy to control and to regulate the Korea Antarctic affairs for environment protection (Y. Kim, 1996). Accordingly, the Antarctic Protection Act, a reflection of both the Antarctic Treaty and Environmental Protocol in Korean law, was enacted in 2004, and therefore the direction of national policy for Antarctic affairs is towards both the protection of the Antarctic environment and the promotion of scientific research in Antarctica (S. Park et al., 2012). Thereafter, several scholars have continuously urged that government should be careful not to use certain controversial words to describe Antarctic affairs. According to “Implementation Strategies for National Antarctic Policies” (2012), the government should make it clear that Antarctica is neither a territory to claim sovereignty over, nor a place to exploit natural resources unilaterally. In 2014, the report from the National Assembly Research Service showed concern for the situation whereby both territorial expansion and securing of natural resources was being pursued through the establishment of research stations in Antarctica, despite it being clearly stated that Antarctica is a region for scientific study (W. Lee, 2014). Also, Seo (2015) was concerned about the usage of “Korea economic territory” to describe Antarctica since both words – “territory” and “sovereignty” – are firmly related in international law. In brief, scholars have consistently advised government and media to follow the global tendency considering Antarctica as the common heritage of mankind.

Lately, the government and press have gradually been influenced by scholars' advice; most especially, the effort to create a new Marine Protected Area (MPA) on the Ross Sea has shown a noticeable change in the perspective of both politicians and press. In 2013, South Korea was lamentably listed as a country whose vessels operated illegal, unregulated, and unreported (IUU) fishing on the high sea, by both the United States of America (3) and the European Union (4). Immediately, the Korean government amended the Ocean Industry Development Act to strengthen the punishment for illegal fishing twice (5) and it supported the creation of the new MPA on the Ross Sea (6). In describing the new MPA, the press emphasised that the key word to describe the Southern Ocean is "preservation" (6). In conclusion, it might be a small change but mighty oaks from little acorns grow.

3.2 Changing perspective on Research and Development in Korea

The government's perspective on the R&D sections has also changed. Previously, the governmental perspective of R&D was primarily for economic development. Indeed, South Korea has substantially invested in applied science to pursue the level of technology and industry of advanced countries. Due to the limits of pursuing this style of R&D, it is essential to modify the fundamental level of national R&D strategy (Jang, 2017). In recent times, the importance of basic research has consistently been shown and, therefore, the Korean government has enlarged the budget of basic research proportionately since 2008. The proportion of investment on basic research in 2008 was 16.4%, which increased to 32% in 2012 and was eventually increased to 40% in 2017 (Jo, Yoon, Kim, Jung, & Son, 2014). Although the financial support from government has rapidly escalated, the R&D system has remained the same.

Subsequently, researchers have requested a change in national R&D strategy accordingly. As a result, the direction of national R&D strategy has changed from a pursuing style to a pacesetting style (Jang, 2017). Each year, the Ministry of Science and ICT has released the national R&D strategy, the government R&D investment direction and its criteria. In the document of 2017, one of nine prior investment points in national R&D strategy is to strengthen research capacity through open source cooperation including international collaboration. Regarding international collaboration, some recent studies from South Korea illustrated the necessity of international collaboration in Antarctic research. To utilise the

method of incremental citation impact (ICI; Inzelt, Schubert, & Schubert, 2008), some Korean researchers studied the citation impact between international and domestic co-authored articles from 13 government-supported Korean research institutes, including KOPRI (J.-Y. Lee, Shim, Se-Jung, Kwon, & Kyung-Ran, 2012).

Table 3. KOPRI data of ICI and published articles (Source: J.-Y. Lee et al., 2012)

KOPRI	Co-authorship	
	Domestic	International
Published articles	95	74
ICI Value	-0.309	0.656

As illustrated in Table 3, the ICI value of KOPRI on domestic co-authored papers is negative but the international value is positive. In fact, the result of KOPRI is similar to 12 other research institutes, which was interpreted as a positive effect on international collaboration compared with the domestic one (J.-Y. Lee et al., 2012). Another study to promote international collaboration is related to a bibliometric method, using scientific publications to not only generalise the pattern but also to summarise the research trend with citation analysis (Ji et al., 2014).

Table 4. Lists of studies using bibliometric data for Antarctic research (Source: Aksnes & Hessen, 2009; Dastidar & Ramachandran, 2008; Duckhee Jang et al., 2016; Ji et al., 2014)

Names of authors	Year of Publication	Database source	Period of analysis	Published articles
Dastidar and Ramchandran	2008	SCI (CD-ROM)	1980–2004	10,942
Aksnes and Hessen	2009	ISI Web Science	1981–2007	53,685
Ji, Pang, and Zhao	2013	Web of Science	1993–2012	30,024
Jang, Choi, and Kim	2016	Web of Science	1998–2015	78,445

As shown on Table 4, there were four types of studies to investigate both the outcome and trend of international collaboration. In 2008, Dastidar and Ramachandran (2008) retrieved 10,942 records from 1980 to 2004 from the SCI database to analyse the intellectual structure

of Antarctic science. Based on their study, the productivity of Antarctic studies has increased three-fold and international collaboration has had a 13-fold increase (Dastidar & Ramachandran, 2008). Using the database ISI Web of Science produced by Thomson Scientific, Aksnes and Hessen (2009) evaluated the trends in polar studies between 1981 and 2007. Analysing about 53,000 articles related to polar research, they concluded that the proportion of international co-authored papers was less than 10% in 1980 and steeply increased to 41% in 2007 (Aksnes & Hessen, 2009). In addition, the rate of international collaboration co-authorship in polar research was 20% higher than in science research in general (Duckhee Jang et al., 2016). Based on the 30,024 articles from the SCI database, Ji, Pang, and Zhao evaluated the Antarctic studies to review global development between 1993 and 2012 (Ji et al., 2014). Even though they all used bibliometric methods to retrieve data, Dastidar and Ramachandran (2008) used “Antarc*” to search articles; Ji, Pang, and Zhao (2014) similarly used the word “Antarctic*”; and Aksnes and Hessen (2009) used bibliographic data on the basis of both content and location of the polar region. Although they applied different methods to retrieve data and distinctive ways to interpret them, it is clear from these observations that the quantitative value of international co-authored papers in Antarctic studies has rapidly increased.

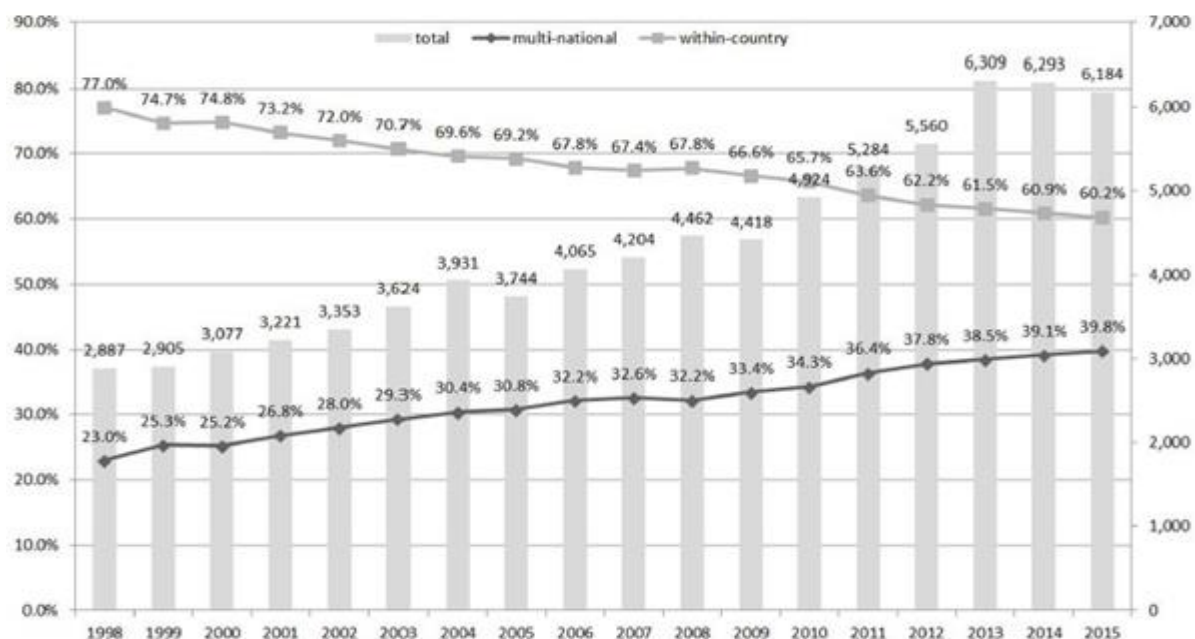


Figure 14. Trends of multi-national research cooperation ratio (Unit: %, number; Source: D. Jang, 2016)

Ultimately, Korea, having more collaborative projects, has shown higher productivity in publishing articles related to Antarctica (Dastidar & Ramachandran, 2008). To establish the

trend in international research collaboration, Jang, Choi, and Kim used bibliometric data and interpreted the retrieved data with social networking analysis. Initially, they used geographic delimitation to define Antarctica as under 60° southern latitude and also used 865 keywords to search and retrieve data from the Web of Science (Duckhee Jang, Yong-Jin Choi, & Jin-Young Kim, 2016). Subsequently, they derived a conclusion that the trend of international collaboration has consistently escalated.

To define the nationality of articles produced by multinational research projects, they used the nationality of the lead author. As shown on Figure 12, 23.0% of the total articles written in 1998 were based on multinational projects and the percentage increased to 39.8% in 2015. In the same year, South Korea published 104 articles in total, but only 31 articles (29.8% of the total) were derived from international research collaborations (Duckhee Jang et al., 2016). In addition, the total number of articles published by Korean lead authors between 1998 and 2015 was 945, and 271 articles were produced through multinational projects, which is 28.7% of the total (Duckhee Jang et al., 2016). Again, the primary purpose of their research was not to evaluate the productivity of articles in general, but the trend in international research collaboration and its effects. In the final analysis, they not only determined that it is essential to conduct more international collaboration projects but were also persuaded that it is necessary to build the supporting strategy extensively and systematically (Duckhee Jang et al., 2016). In short, the national R&D strategy was recently changed to seek international collaboration, and also several international and domestic bibliographic studies have explained that international collaboration in Antarctic studies is not only the global trend but also an effective way to enhance the outcome. Thus, the next question concerns which country South Korea should work with. An interesting result from the survey showed that New Zealand was ranked in second place to reinforce the bilateral relationship for international research collaboration in the future (S. Park et al., 2012).

3.3 Just beginning of Korea – New Zealand Antarctic relationship?

The Republic of Korea (South Korea) may not be a country as well known as the United States of America or China, but the public may have heard about the nuclear threat of North Korea, PSY's *Gangnam Style*, or that it was the hosting nation of the 2018 Winter Olympics. In fact, South Korea has had a long-established relationship with New Zealand for

decades. It began with the Korean War of 1950: only eight days after the first gun shot, New Zealand immediately responded to the request of the UN resolution and sent a navy frigate to secure Korean territorial waters. In total, New Zealand sent about half of the total force, about 6,000 army and navy personnel. To protect freedoms in South Korea, 45 Kiwi soldiers perished in battles and the remains of 34 were interred in state at a UN cemetery, located at Busan Metro City. To monitor the armistice agreement, three officers were deployed from the New Zealand Defence Force around the demilitarised zone and one officer was sent on a mission as the contingent's senior officer in Seoul, the capital city of South Korea.

In terms of their diplomatic relationships, South Korea–New Zealand (KR–NZ) initiated an official channel in 1962 and opened the embassies on both New Zealand and Korean soil in 1971. Seeking mutual benefit, Korea–NZ have made various agreements. In 2015, KR–NZ signed a free trade agreement (FTA), an economic relationship for mutual benefit. Indeed, South Korea is New Zealand's sixth-largest exporting partner and the total amount of trade in 2017 was recorded at about NZ\$4.3 billion. The NZ MOFA and MFAT reported that the KR–NZ FTA had contributed to provide mutually positive results from trade. Compared with the same term in 2015, the export amount of wine increased by 29%, deer velvet by 125% and cherries escalated by 220%. In all, the forestry market of New Zealand directly earned about NZ\$2 billion by trading with South Korea, showing a 28% enhancement over the previous year, making South Korea the second-largest exporting partner in the forestry market (MFAT, n.d.).

Another momentous agreement was made in 2012: a bilateral agreement on Antarctic cooperation. In order to build their second Antarctic research station at Terra Nova Bay, Korea recognised that New Zealand had a geophysical benefit as a gateway. The Antarctic cooperation agreement was mainly for facilitating and supporting the Korea Antarctic Program, and later in 2014, KOPRI signed a letter of intent (LOI) for future Antarctic research collaboration and the sharing of infrastructure with Antarctica New Zealand. On that account, South Korea became the fourth National Antarctic Program to choose Christchurch as a gateway to Antarctica. In fact, South Korea is one of New Zealand's key partners in Antarctic affairs and, consequently, it is important to know their intentions regarding Antarctic research

As mentioned, New Zealand and South Korea have enjoyed a long history of

collaborating on a number of different matters such as military and diplomatic business, and trade. Recently, the Antarctic angle was added and Korea now views New Zealand differently. Due to the establishment of the Jangbogo research station, the academic concept of Antarctica New Zealand was often accompanied by either one of the original signatories of the Antarctic Treaty (J.-w. Kim, 2016; Yoon & Choi, 2012) or as one of five gateway cities to Antarctica (S. Park et al., 2012; Yoon & Choi, 2012). Antarctica New Zealand is highly appreciated for four reasons: its world-class search and rescue system, being a leading country for its environmental impact statement, its colloquium style in setting up national Antarctic policies, and more importantly, the substantial degree of activities by non-governmental Antarctic organisations (S. Park et al., 2012).

Chiefly, the survey by Park et al. (2012) was designed to measure the degree of understanding of Antarctic policies and to collect feedback from experts for future Korean Antarctic policies. It had four purposes: (1) to comprehend the problems and limiting factors of Antarctic affairs, (2) to gather the opinions about achievements and feedback from Antarctic policies, (3) to check the intelligibility and direction for improvement of both Antarctic Treaty and domestic law, and (4) to derive the progress direction of Korean Antarctic policies for the future. With the four purposes of the survey in mind, it was divided into five sections with 21 questions. The survey was conducted with 57 experts between 17 September 2012 and 5 October 2012, and was answered by 45 participants. Interestingly, the majority of the participants (91.1%) had work experience related to polar studies and 53.3% had been working in government-supported research institutions for more than 10 years. It is interesting, though, that those polar experts, with long-term working experience in research institutes, decided that New Zealand was the second-most important country with which to conduct international collaboration (S. Park et al., 2012).

Because of its geographical advantage, the New Zealand Antarctic Program has a distinctive characteristic; through international collaboration, they have not only contributed to advancing scientific research but also promoted domestic economy (Saunders et al., 2016). Subsequently, The Antarctic Office (TAO) was launched by the Christchurch City Council to improve its role as a gateway city (Cairns, 2014). Even the regional government has shown support for Antarctic research. Considering both the long history of Antarctic research and strong support for it at both national and regional level, the Antarctic scholars from South Korea

also consider that New Zealand is an important partner in Antarctic research. As previously mentioned, there was a single official document between KOPRI and Antarctica New Zealand at the start of gathering relevant information for this dissertation in 2017. But several research collaborations have now been conducted between New Zealand and South Korea. Recently, six research collaborations between KOPRI and New Zealand Antarctic scholars have been conducted or will be conducted together in Antarctica and the Southern Ocean. Considering that this is the beginning stage of our relationship, this particular point leaves much to be desired. As this thesis has consistently proposed, the Korea Antarctic Program has on insisted their preference for international collaboration. Moreover, some other Korean institutions, besides KOPRI, have shown their willingness to cooperate on Antarctic affairs. The Korean government and research institutions obviously recognised the extent to which international collaboration in science would be more efficient by sharing resources, and significantly, New Zealand is obviously a very important partner in the area of Antarctic research. In brief, New Zealand should formulate a plan to promote more opportunities to practice international collaboration with Korea.

4. A comparative case: The Chinese Antarctic Programme

There are some reasons to illustrate the Chinese Antarctic Program (CAP) in this paper. Although the Chinese Antarctic Program was initiated only four years earlier than South Korea's, they currently have two permanent research stations, two seasonal stations, two aircraft, and two research ships with capability to survey the Southern Ocean. Both NAPs, Korean and Chinese, have shown relatively rapid growth in Antarctic affairs within the short term. Those aggressive investments might cause a misapprehension of the CAP's intentions regarding Antarctic affairs. Another reason is the potential of CAP's settlement in both the Ross Dependency and New Zealand. Without a doubt, the People's Republic of China (PRC or China) has raised several problems related to territorial issue in foreign affairs. Accordingly, those phenomena provoked the other NAP's dubious attitude even if CAP has consistently maintained their willingness for international collaboration. Still the question is whether international collaboration provides the benefit for only one side.

True international collaboration does not seek unilateral benefit but provides mutual benefits to all participants. In other words, the participants of multinational projects would not lose anything but would expand their opportunities through sharing tangible and intangible assets. The implementation of previous multinational research collaborations has been done under the condition of sharing the access to their infrastructure and logistics in or outside Antarctica (Erb, 2011). Subsequently, it would be interesting to see the will and expectation of new Chinese research station in Antarctica. In April 2018, the PRC publicly announced the draft Comprehensive Environmental Evaluation (CEE) to construct a new research station on Victoria Land, Antarctica. More importantly, they are expecting to promote the "multinational and multidisciplinary research collaboration" in the Ross Sea area through the new research station (Polar Research Institute of China and Tongji University, 2018). Considering the previous cases of the USA, Italy, and South Korea, it is highly possible that China will become another country to base their National Antarctic Program in Christchurch, New Zealand. As continuously shown by the Korean Antarctic Program, it is important to understand the historical development and the direction of Antarctic policies within the Chinese Antarctic Program.

4.1 History of Chinese Antarctic programme

In the same way as other NAPs, the Chinese Antarctic Program was initiated under government support. On 21 February 1964, the Central Committee of the Communist Party of China officially ratified the establishment of the State Oceanic Administration (SOA) and noted that “Researching Arctic and Antarctica” was one of their main tasks. In 1966, the SOA was officially tasked with an assignment to engage work related to Antarctica “at the proper time” (Brady, 2010). Because of the chaotic domestic status, the issue of Antarctica was delayed and brought up again after the Cultural Revolution (Zou, 1993). Due to the adoption of a “reform and opening up” policy under China’s new leadership, an international research collaboration on Antarctic studies was discussed and finally processed, resulting in two Chinese scientists being sent with the Australian Antarctic Research Expedition between 1979 and 1980 (Brady, 2010). Right after the joint expedition, in 1981, the National Antarctic Expedition Committee was launched to operate the Chinese Antarctic Program and to expedite international collaboration. The PRC officially became a member of Antarctic Treaty System in 1983 and acquired a position as a consultative party of the treaty in 1985 (Zou, 1993).

To illustrate the development of Chinese Antarctic affairs, Zou Keyuan (1993), a professor of international law, simply divided the period between 1978 and 1994 into three stages. The first stage is the period of acquiring experience and expertise from other Antarctic agencies. Basically, this is the period to learn how to form a country’s own national Antarctic programme, based on the expertise of others. To obtain preliminary Antarctic knowledge from others, 42 Chinese scientist participated in multinational projects with Australia, New Zealand, Chile, Argentina, Japan, and West Germany until 1987 (Zou, 1993). The second stage was the period of establishing their own research station and initiating the Chinese Antarctic expedition. During the time between 1985 and 1989, China actually constructed two permanent stations in Antarctica; accumulating experience to operate in Antarctica, they decided to build the first Chinese station outside the polar circle. In 1985, Changcheng Zhan (Great Wall Station), the first Chinese permanent base, was established at King George Island, located on the Antarctic Peninsula, with seven other Antarctic national programs. After a few years of practice, China finally decided to build an inland Antarctic station. The second permanent research station was built in the eastern sector of the Larseman Hills in 1989 and named after the father of modern

China, Sun Zhongshan. Furthermore, the Polar Research Institute of China was established in 1989 to promote a higher quality of Antarctic research.

Lastly, the third stage, primarily between 1990 and 1994, was the time to move their focus onto scientific research. Yet, this stage was highly influenced by the domestic factor of the pro-democracy movement in June 1989. The Chinese foreign policy of 韬光养晦(TAO GUANG YANG HUI; low profile and conciliatory diplomacy), by Deng Xiaoping, not only dramatically changed China's perspective on international collaboration but also advocated the Antarctic strategy to "consolidating rather than expansionist" (Brady, 2010). In response, the expected international collaboration was totally hampered by insufficient funding, which slowed the pace of China's Antarctic affairs. Subsequently, the Chinese Antarctic Program did not have any other option but to focus on scientific research themselves. In 1994, the Chinese Advisory Committee for Polar Research was founded as a further polar bureaucratic branch. Even though this committee is led by the State of Oceanic Administration, it still has a duty to advise all Chinese government departments on any polar-related issues (Brady, 2010). Within the same year, China bought an ice-strengthened ship from Ukraine, refitted it as research vessel (RV) for Antarctic expeditions, and named it *Xue Long* (the snow dragon in Chinese; S. Park et al., 2012). In 1999, at the beginning of China's Arctic expedition, the presence of RV *Xue Long* surprised the Canadian authorities because of showing the capability of operating ice-strengthened ship under Chinese authority (Chircop, 2011). Since then, RV *Xue Long* has consistently conducted Arctic expeditions and carried scientific equipment for marine chemistry, biology, marine biology, geology, oceanophysics, and atmospheric chemistry. Unfortunately, China's Antarctic governance had a low profile during the third stage due to their foreign policy.

Interestingly, Ann-Marie Brady, a professor of political science from University of Canterbury, urged that Chinese Antarctic activities move into a new stage and illustrated the additional stage four in Zou Keyuan's concept of stage divisions (Brady, 2010). This fourth stage from 2005 to 2010 was when China started to seek a leadership role in Antarctica. During stage four, China expressed their aspiration to be a leading nation in Antarctic affairs in multiple forums and successfully aroused public awareness about Antarctica. Subsequently, Chinese government expenditure on the Antarctic program was substantially increased (Brady, 2010).

For instance, China has utilised media to announce their momentous achievements with emotive words. On 18 January 2005, a Chinese expedition towards Dome Argus, the last untouched and geologically important territory, successfully delivered their mission to “conquer” the peak of Dome A. Since the first Chinese attempts in 1996, it took approximately a decade to accomplish the goal. Another remarkable moment was the 130-day expedition on the Grove Mountains, where they named several geologically significant points in Chinese. Consequentially, these two significant successes to conquer and to name the places brought a significant movement in “China’s political standing in Antarctic affairs” (Brady, 2010).

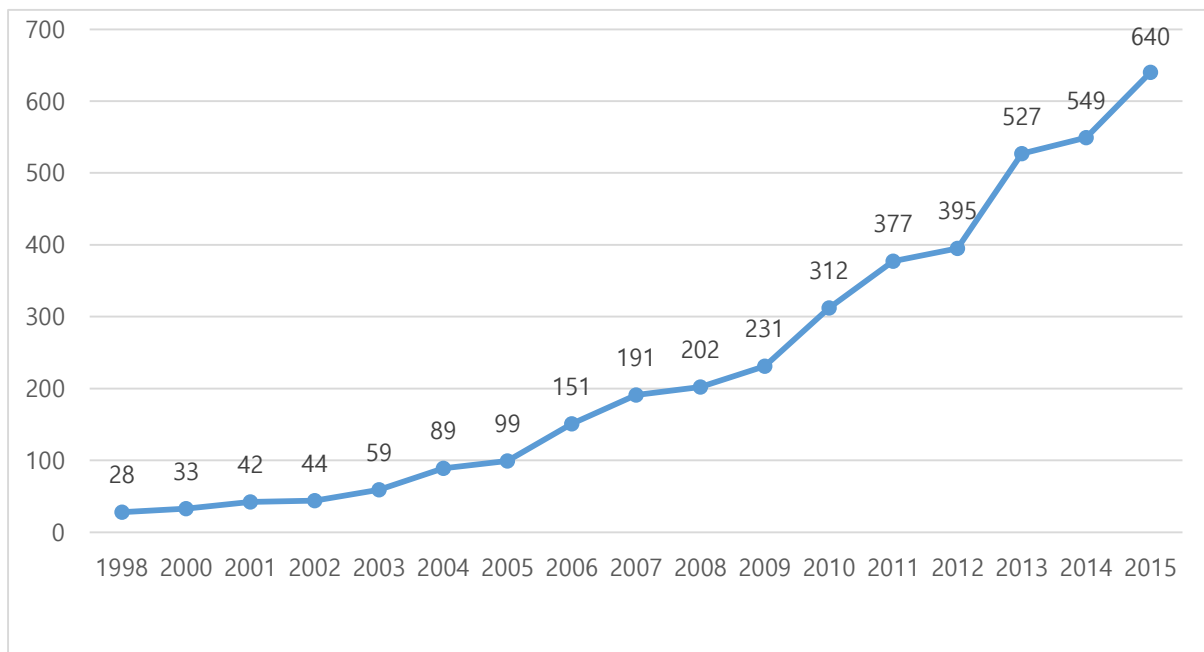


Figure 15. The number of Articles annually published by Chinese Researchers (Source: D. Jang, 2016)

Another interesting factor is applying the stage divisions with bibliographic analysis on Chinese Antarctic studies between 1998 and 2015. The number of articles produced by Chinese researchers has gradually grown from 1998, as shown in Figure 14. One possibility of explaining this consistent growth is that it is related to the development of Chinese Antarctic infrastructure. After approaching safely and continuously to Dome A, the Chinese Antarctic Program established one summer station to conduct scientific research and one camp to facilitate logistic support. In 2009, Kunlun Station was constructed on Dome A but previously Taishan camp had been established between Kunlun Station and Zhongshan station in 2004. Even if the whole purpose of inland traverse and building the Taishan camp was to facilitate logistics for Kunlun Station, Chinese researchers could still expand and reorganise their tasks in Antarctica (Brady, 2012). During the time from stage 1 to stage 3, the average number of

published articles on Antarctica was about 49 per year, and stage 4 produced about 198 per year. During the period between 2011 and 2015, the Chinese published about 498 articles per year. Considering this chronological order and notable recent changes, it is possible to include another stage. Accordingly, stage 5 is blooming – the time of Chinese Antarctic research. Since 1984, the Chinese Antarctic Program has officially started a Chinese Antarctic expedition and rapidly developed Antarctic infrastructure. On that account, the advancement of infrastructure provided more opportunities to Chinese scholars, which subsequently contributed to increasing the productivity of outcomes.

4.2 Chinese Antarctic-related institutions and their connection

In the same way that South Korea made Antarctic protection laws, the Chinese government also legislated a protocol to support their Antarctic affairs. According to the “China 21st Century Maritime Protocol”, the SOA has total responsibility for controlling Chinese Antarctic governance and the Chinese Arctic and Antarctic Administration (CAA; S. Park et al., 2012). In other words, China’s Antarctic strategy is one of the offices under the SOA, having the responsibility for Antarctic and Arctic research.

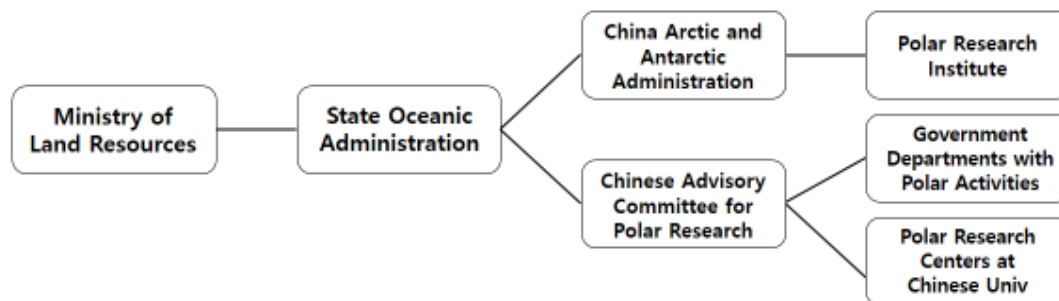


Figure 16. Chinese Antarctic Institute Organization Chart (Source, Brady, 2010)

As shown in Figure 16, China has several Antarctic-related institutions, but they use a two-channel system. One is mainly responsible for Antarctic research and its logistics and the other is a cross-agency institution navigating Antarctic governance (Brady, 2012). In brief, one channel is for scientific research and the other primarily for politics. Despite this, all of the polar institutions are interconnected, often in complex relationships. As previously mentioned, the Chinese Advisory Committee for Polar Research (CACPR) was launched in 1994 by the Ministry of Science and Technology, and SOA currently heads CACPR (Heggelund, 2007). This committee consists of 16 member institutions, including government ministries, research

institutes, and universities, whose roles are varied and include monitoring, consulting, and evaluating both Antarctic expeditions and their outcomes, but focused on governmental function.

Due to the proclamation of China's 21st Maritime Protocol in 1996, the National Antarctic Expedition Committee was renamed the Chinese Arctic and Antarctic Administration and was positioned under SOA. This institution has about 40 employees and has three functions, such as arranging Antarctic research domestically and internationally and processing administrative matters related to polar issues (S. Park et al., 2012). One other important task is supervising the Polar Research Institute of China (PRIC), which was opened at Shanghai in 1989 and currently employs 154 personnel. PRIC is a front-line institution, leading national Antarctic and Arctic organisations to deal with any polar-related activities in China. Its four main tasks are: (1) administering China's polar research; (2) regulating both Arctic and Antarctic expeditions; (3) supporting the logistics for both expeditions, including management of all stations four Antarctic and one Arctic station) and maintaining the ice-strengthened RV *Xue Long (Snow Dragon)*; (4) management of data related to Polar research (Brady, 2017). China Arctic and Antarctic Administration is focused on adjustment of planning and cooperation related to polar research activities, while PRIC is the institution that practically administers polar research and arranges the logistics for both expeditions (Brady, 2010). Even though all Antarctic-related (or polar-related) institutions can be classified into two channels, they are interrelated in a complex fashion.

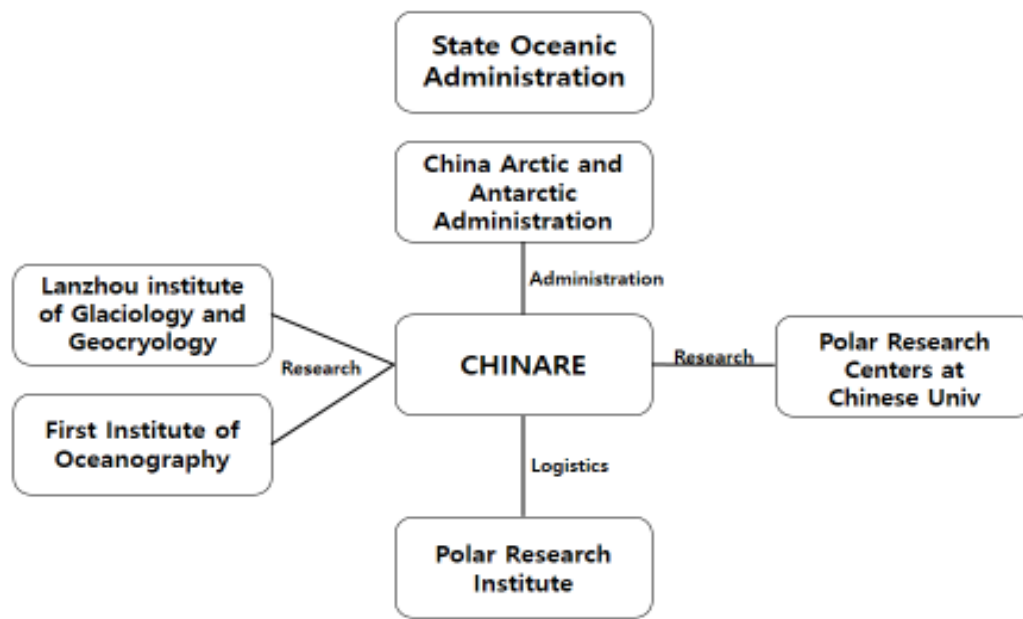


Figure 17. CHINARE Related Institute Organization Chart (Source: S. Park et al., 2012)

There is another way to describe their connection, however, since all Antarctic-related institutions are involved with China's Antarctic Expeditions. The CHINARE (Chinese Antarctic Research Expedition) is, clearly shown by its name, the southern direction expedition and consists of governmental and scientific institutions including universities. As shown in Figure 17, the connections of CHINARE with various institutions can be distinguished by three roles: research, administration, and logistics. Alongside CHINARE, PRIC has facilitated all logistic tasks, CAA has coordinated administrative issues and lastly, the research institutions have proposed their Antarctic-related work for CHINARE.

4.3 Different Perspectives on China's engagement in the Antarctic

After Mao's death and the aftermath of the Cultural Revolution, the Chinese economy was struggling and even desperate for recovery at times (Roach, 2014). During the power transition in 1978, Deng Xiaoping, a revolutionary and politician of modern China, argued that "Poverty is not socialism" and encouraged the implementation of the "Four Modernizations", a radical path for economic development with an emphasis on national defence, agriculture, industry, and science and technology. Therefore, in December 1978, the third Plenary Session of the 11th Central Committee of the Communist Party of China declared a new economic reform: "Socialism with Chinese Characteristics (中国特色社会主义)", to rebuild and open

the country (Tisdell, 2009). As a result, the economic policies brought an economic boom that resulted in a tripling of average income by the early 1990s. Based on World Bank calculations, Deng's reform saved about 170 million peasants from extreme poverty (Ebrey, 2010).

Deng's pragmatic perspective of governance not only brought radical change in the diplomatic environment but also established the foundation for Antarctic research. Because of domestic turmoil, its reform and open policy was adjusted in direction towards "low profile and conciliatory diplomacy", which also contributed to Antarctic research's retrogression when compared with others, and therefore, information about China was hidden and even it was difficult to research about the Chinese Antarctic Program for this paper. Since then, communication with China has been seemingly not bilateral but unilateral. Within its rapid economic growth, China has recently been acclaimed as a G2 country with the United States of America and has invested tremendously in Antarctic affairs. With a combination of limited information and aggressive investment in Antarctica, how does it look to outsiders? In fact, the internal and external viewpoints have a broad distinction. Providing an inner perspective of China, the China Pictorial, a monthly magazine with long history from the 1950s, introduced the report of "China's Antarctic Activities" with an interview of one author. According to the story, China has endeavoured to conform to the international perspective, being protective and preserving the Antarctic environment. A day before the 40th Antarctic Treaty Consultative Meeting was held in Beijing, China, in 2017, the SOA announced a white paper, which contained 30 years of Chinese Antarctic affairs (Huang, 2017). Xu Shijie, one author of the report, explained that China has been suspected or is accused of intending to exploit resources, to present military forces, or to posit a particular strategic purpose. The report is a response to clarify China's stance on the speculation concerning the exploitation of natural resources (China Pictorial, 2017). Previously in 2014, Chinese President Xi Jinping and Australian Prime Minister Tony Abbott signed a bilateral MOU in Hobart, Australia, to recognise the Antarctic relationship between Australia and China. At that time, President Xi visited the Chinese ice breaker RV *Xue Long* and expressed his appreciation for all the scientists in their arduous research "to explore new areas of science and [provide] better protection for the environment" (Hodgman, 2014). He also mentioned "understanding and peaceful utilization of Antarctica".

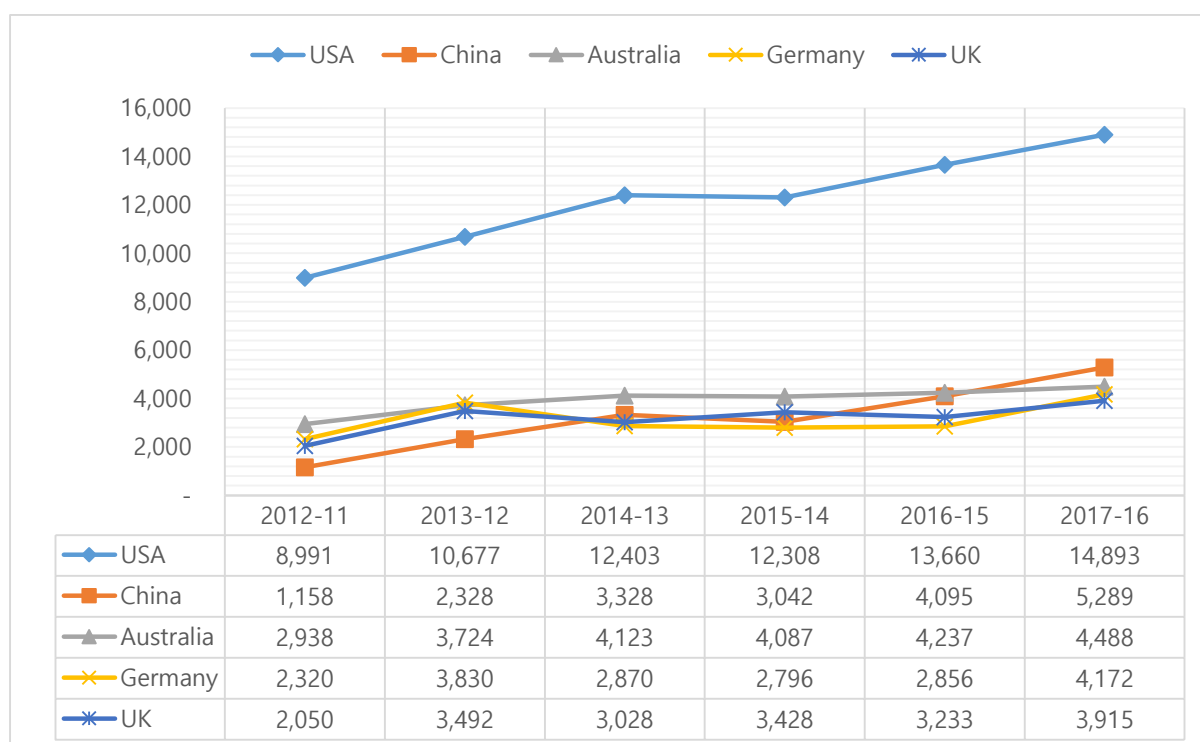


Figure 18. Antarctic tourists by nationality (land, air, cruise; IAATO, n.d.)

In Chinese Antarctic affairs, not only scientific research but also Antarctic tourism has increased. Due to developments in technology, transportation, and everyday living style, it is more common to find Chinese vessels and visitors in Antarctica. According to the International Association of Antarctic Tour Operators annual tourist data, the number of Chinese visitors to Antarctica annually was ranked second, after the United States of America, in the Antarctic season between 2016 and 2017. As shown in Figure 18, the Antarctic tour for Chinese visitors officially started the season between 2011 and 2012. The initial number in 2012 was 1,158 visitors and rapidly grew to 5,289 in 2017, which is 39.8% annual growth. Compared with the United States of America (10.8% annual growth), the nation with the most visitors, and Australia (9.2% annual growth), with the third-largest visitor numbers, the growth rate of Chinese tourists is incomparable with any country. Moreover, the growth rate of the top four nations has been steady, and the ranking has not changed for a decade. Despite its dramatic growth, the actual number of Chinese visitors (5,289) to Antarctica has been far smaller than for American visitors (14,893). Still, it is hard to neglect the Chinese visitor factor in re-initiating the Antarctic tourism boom. As shown in Figure 18, the total number of visitors reached a peak in 2008 and plummeted in 2012 because of the global economic recession.

Unsurprisingly, it is no coincidence that Chinese tourists brought about an Antarctic tourism boom once again.

In December 2017, the first Chinese commercial flight brought 22 tourists from Hong Kong to Antarctica, via Cape Town, South Africa. In describing this first touchdown of a Chinese commercial plane, the foreign press had a worried tone. For instance, BBC published an article to introduce this event with several questions. In one of the questions, the journalist was concerned about China's new frontier strategy on Antarctica and interpreted it as "strong political will" in order to shape the strategy of the South Pole according to their interests in the near future. In brief, the outsider's perspective was quite different from that of the Chinese (Illmer, 2017).

From Chinese Scholar's perspective, the intention of Chinese government to pull enormous amounts of funding into Antarctic research has been controversial. Yet, it is obvious that a foreigner's viewpoint on China's Antarctic affairs is much dubious because of limited accessibility to information about China, especially on the establishment of its Antarctic strategy. To set up Antarctic strategies of their own, China, in the same way as the other 28 consultative members of Antarctic Treaty, has thoroughly studied how to reconcile its national interest with its international duty. Given the history of China's development, modern scholars have argued that the dramatic development in economic wealth has required the rapid consumption of resources and therefore China has shown interest in natural resources from wherever they are obtainable. Therefore, the enormous amount of energy resources underneath Antarctica is one of the reasons why there have been concerns about China (S. Park et al., 2012). In other words, China has an interest in Antarctica because of abundant natural resources (Brady, 2012). Some other scholars have pointed out that China has recognised Antarctica as untapped territory and wanted to insist on its stake of resources in Antarctica. To put it another way, one of China's Antarctic strategies is to build research stations around the Antarctic continent, and notable research outcomes are an indirect way to claim their right or stake in Antarctica (Duckhee Jang et al., 2016). Due to the rapid development of the CAP, there have been some worries expressed with an argumentative tone. As mentioned above, several scholars and media have closely observed each step of the CAP and they have deep concerns about those aggressive investments.

In spite of the new political system in China, it might be too soon to determine that the perspectives of the Chinese government and their scholars are the same. Of course, both political and diplomatic concerns in Antarctic affairs have never been neglected, but the new movement towards international collaboration is to no longer consider Antarctic research as a currency to amplify one's influence over Antarctic affairs. Literally, the CAP has shown its enormous willingness to undertake Antarctic research through aggressive development of their programme and publicly announcing their interest to practise more international collaboration in Antarctica. Based on the Antarctic Treaty, Antarctica is not a continent in which to pursue conflicts over political issues but a continent to seek for scientific knowledge. Like the change in the Korean government's perspective on Antarctica, is there any possibility that the Chinese government can change their perspective? It would nevertheless be difficult to understand the CAP with the same approach as the KAP, and therefore, it is necessary to do research on the various perspectives of the CAP.

5. Conclusion and possible future pathways to enhance collaboration

Sometimes, academic ideas are considered by society as either too ideal or too unrealistic. Personally, I feel those ideas can sometimes provide different angles to expand potential opportunities. Before drawing conclusions, a potential opportunity for enhancing collaboration between Korea and New Zealand will be discussed, starting with the Antarctic research of the Democratic People's Republic of Korea (DPR Korea or North Korea).

Post World War II, some countries were forcibly divided by ideological conflict, and the world regrettably faced another phase of ideological conflict, the Cold War. Interestingly, the issue of claiming territory in Antarctica had already emerged and some states showed concern that the region might become a “pawn” between the United State and the Soviet Union during the Cold War (AAD, 2016). Meanwhile despite the rising conflicts, both states surprisingly compromised to use Antarctica for peaceful and scientific purpose only (ATS, 2011). Finally, the Antarctic Treaty was signed with 12 original signatories, and was the first international agreement on arms control during the Cold War (Ham, 2014). At the Antarctic Treaty Consultative Meeting (ATCM) in 1991, the Soviet Union submitted an information paper to introduce their consistent research collaborations between Soviet Antarctic expeditions and Antarctic organisations of other countries dating from 1957 (ATCM, 1991).

The Soviet Union consistently invited Antarctic agencies of other countries to join the Soviet Antarctic expedition (SAE). The first German Democratic Republic (East German) Antarctic expedition as guest scientists was started by invitation of the SAE in 1959 and both a summer and overwinter camp were conducted (Miller, 2007). Since then, East German scientists have collaborated with the Soviet Antarctic programme, later establishing and permanently operating a research base around the Soviet research station, Novolazarevskaya, located in the Schirmacher Oasis of eastern Dronning Maud Land (Gernandt, Gloede, Feister, Peters, & Thees, 1989). In 1974, East Germany joined the Antarctic Treaty, five years earlier than West Germany. Once East Germany became a consultative party of the Antarctic Treaty in 1987, they started to operate the research base independently from the USSR and named it “Georg Forster Station” (Miller, 2007). West Germany became the Consultative Party of the Antarctic Treaty in 1981, after both East and West Germany were invited to the consultations for the Convention for Conservation of Antarctic Marine Living Resources by the Australian

government (Hempel, 1983).

Unfortunately, without the status of consultative party, they could not implement their idea for Antarctic Marine Living Resources. Interestingly, the participating consultation contributed to increasing the awareness of both the government and the public, and consequently the necessity for polar research emerged. In 1979, the Bundestag (Parliament in Germany) unanimously determined to invest in a substantial grant for Antarctic studies (Hempel, 1983). In view of this, the role as mediator in Antarctic affairs through international collaboration was not just an efficient way to promote scientific research but was also profitable in reinforcing the relationship between countries that conduct Antarctic studies. In addition, the Soviet Union not only led East Germany into Antarctic studies but also invited North Korean scientists to the SAE. According to the ATCM in Venice (1992), the North Korea delegation submitted the working paper to announce their second Antarctic expedition with the Soviet Union (ATCM, 1992).



Figure 19. Antarctic History of North Korea (Source: KCNA, 2010; ATCM 1992)

Although North Korea joined the Antarctic Treaty in 1987, they started by conducting an Antarctic expedition with the support of the Soviet Union. In May 1990, North Korean scientists first arrived on Oasis Tereshkova and surveyed the area for a site for a potential Antarctic research base; this was the first Antarctic expedition of North Korea (KCNA, 2010). To commemorate this first Antarctic expedition, a signpost was erected with the initials of the “First Antarctic Expedition Team of the Democratic People’s Republic of Korea” at a location of 67° 55’ 23” S 44° 32’ 10” E (KCNA, 2010). The second Antarctic expedition team was organised with four North Korean scientists and prepared for both the construction of a summer base and overwintering research base. The head of the team was Zang Gi-Bong, a meteorologist

from the State Hydrometeorological Administration, and other teammates were a meteorologist from the central weather forecast institute, an oceanographer from the oceanographical institute of the Korean West Sea, and a geologist from the Hydrological Research Institute (ATCM, 1992).

In the next austral summer, the second Antarctic expedition team arrived successfully at the Soviet Antarctic station, Molodyozhnaya, on 18 December 1990, and immediately began to build the summer base. The base, located at the same place as the signpost ($67^{\circ} 55' 23''$ S, $44^{\circ} 32' 10''$ E), was constructed with a covered size of 157.6 m^2 in five days and named “GEZEL-1” (Season-1) (KCNA, 2010). After construction, the team was divided into two groups – one group stayed at Season-1 base from 22 December 1990 to 8 April 1991, and the other group went to the Soviet’s Progress base from 28 December 1990 to 12 March 1991 (ATCM, 1992).

For about 100 days, they studied the weather, coastal ice, geological features, and sampling data (KCNA, 2010). After summer camp, they returned to the Soviet Molodyozhnaya station and conducted overwintering research between 9 April 1991 and 22 August 1991. To celebrate the 20th anniversary of North Korea’s Antarctic expedition, the Korea Central News Agency (KCNA) published a newspaper story in December 2010 to introduce the country’s Antarctic history. Based on the newspaper story (KCNA, 2010), the second expedition team determined the potential place to establish the fixed research base and, again, marked with a signpost bearing the country and national flag at the location of $69^{\circ} 22' 28''$ S and $76^{\circ} 23' 30''$ E. In other words, North Korea has consistently been interested in studying Antarctica. The real problem, however, is that the status of North Korea is still under United Nation Sanction, including the Travel Ban sanction. It may be possible, however, to conduct a multinational research collaboration between the Democratic People’s Republic of Korea (North Korea) and the Republic of Korea (South Korea) with the support of Antarctica New Zealand.

Based on the information announced in 2015, North Korea had diplomatic relationships with 160 states worldwide (Ministry of Unification, 2017) and New Zealand is one of these nations. The diplomatic relationship between New Zealand and North Korea was established in March 2001, and the Minister of Foreign Affairs with 13 officials visited North Korea in 2007 (Bellamy, 2012). During the visit of the New Zealand delegation, North Korea

expressed its interest in expanding the relationship and areas of cooperation (Houlahan, 2007). Despite the previous denuclearisation under Kim Jong Il's regime not being successful, his son recently expressed thoughts on complete denuclearisation (Reuters, 2018). Under the condition of denuclearisation, New Zealand has continuously shown its interest in providing economic development aid to North Korea (Bracewell-Worrall, 2017). In April 2018, the leader of North Korea insisted on suspending all missile tests and eventually closed the site for nuclear tests (McCurry, 2018). The change in North Korea's stance has caused South Korea to consider some practical ways to expand the relationship from various perspectives. Subsequently, the Ministry of Unification has already started to survey for a cooperation plan with North Korea through international organisations or multinational collaborations including research institutes (Lim, 2018). In short, both South Korea and New Zealand seemingly have common ground for building an Antarctic relationship with North Korea. In view of this, it would be a controversial idea but still interesting that international collaboration of both North and South Korea with New Zealand might provide not only advancement in scientific research generally, but also expansion opportunities in several areas in Antarctic research.

In conclusion, the relationship between New Zealand and South Korea was initiated during the Korean War. About sixty years later, that relationship has been deepened through Antarctica in 2014. New Zealand has a profound level of Antarctic studies since the heroic era of Antarctic expeditions. Previously, the result of Antarctic research was considered as a peculiar type of currency but the endeavour of Antarctic experts has passionately shifted the concept towards international collaboration, which is the origin of the Antarctic Treaty. Many states, including South Korea, believe that Antarctica New Zealand expertly organises and efficiently operates its Antarctic research with limited resources. There is not solely a geophysical benefit in collaboration, but also New Zealanders' flexible responses in their international collaboration. But the small amount of collaborative research with South Korea does not reflect New Zealand's own flexibility on cooperation. As mentioned, it might be misapprehension or lack of understanding of the perspective of the Korea Antarctic Program. This thesis maintains that the comprehension of others about the KAP starts with the history of its development, and the development is profoundly interrelated with the improvement of infrastructure. Definitely, KOPRI is the main Antarctic research institute in South Korea but there are other institutes that have shown their willingness to collaborate on Antarctic research.

In my opinion, this information might provide more opportunity for potential collaboration. Unlike Antarctica New Zealand, most Antarctic institutes seemed neither systematically nor deeply interconnected. Moreover, South Korea has announced their Antarctic strategy every five years since 2007. The third Five-Year Plan pointed out the significance of international collaboration, and simultaneously the Korean government published their change in perspective on R&D collaboration with other advanced institutes in foreign countries. Another noticeable point is the change of the Korean government's perspective on Antarctica itself. With persistent persuasion from scholars, the words of politicians have been carefully used to describe Korean Antarctic affairs. In summary, the intention of this thesis is to promote more research collaboration between New Zealand and Korea through deepening comprehension of KAP. Lastly, this thesis also explores the Chinese Antarctic Program.

Personally, it might be too soon to determine attitudes towards the CAP. Both China and South Korea have experienced the turbulent improvement of Antarctic research and it would be possible that the radical developments have caused some misunderstanding. For better understanding of the CAP, it is necessary to know the history of its development and structure. It is evident that China has abnormally enlarged their Antarctic infrastructure and used inappropriate words to inspire their fellow countrymen. In Antarctic affairs, consultation is basic concept among all NAPs, and the political and diplomatic perspectives are vital. But Chinese Antarctic scholars have shown their willingness to work with other NAPs and have undertaken several collaborations with them. Returning to the original concept of the Antarctic Treaty and need for international collaboration, Antarctica is not a continent to show political willingness but is a continent to pursue scientific truth with humanity.

“Collaboration is not between countries but is between people, and collaborative programmes with equal partners is essential” wrote Roy Daniel and Roberta Farrell from the University of Waikato (Harrowfield, 2007, p. 175).

International collaboration on Antarctic research might seem to be a relationship between countries, but in practice it is a relationship between Antarctic scholars. Building thoughtful relationships between people, from relevant institutes, therefore, would consolidate future relationships and eventually promote more international collaboration.

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